DECEMBER 1961
VOL. XXXI, NO. 5

Review of Educational Research

GROWTH, DEVELOPMENT, AND LEARNING

AMERICAN
EDUCATIONAL RESEARCH ASSOCIATION

REVIEW OF EDUCATIONAL RESEARCH

The purpose of the REVIEW is to report the major research findings during a designated period, organized by areas of interest. The REVIEW identifies the significant studies, summarizes them, and, within limitations of space, critically analyzes them. It seeks to present syntheses of research findings which reflect educational insight and stimulate new research.

The more active fields of educational research are reviewed every three years; the less active fields are included in alternate cycles. (See inside back cover.)

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REVIEW OF EDUCATIONAL RESEARCH

Official Publication of the American Educational Research Association
Contents are listed in the Education Index.

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Growth, Development, and Learning

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FOREWORD

The major premise guiding the selection and organization of material for this issue has been the conviction that research in growth, development, and learning could be interpreted most meaningfully to the educational specialist if considered in relation to classroom learning. Developmental trends during the life span—particularly those of a cognitive nature, but not excluding trends in social, emotional, and personality development—are obviously relevant. Since these trends influence the cognitive, motivational, interpersonal, and social determinants of classroom learning at every age, they must be taken into account by all persons concerned with teaching and curriculum development.

Perceptual and cognitive development are emphasized here more than in previous issues on growth, development, and learning, because they have greater relevance for cognitive aspects of classroom learning than do social, emotional, and personality development. After a quarter-century of virtual neglect, during which educational and developmental psychologists have emphasized personality and social development in teaching and research, cognitive development has emerged as an important focus of research and general interest for the educator. The traditional chapter on physical growth was omitted from this issue: it was felt that such specialized topics as physical growth, motor development, nutrition, congenital disorders, and prenatal development are not specifically relevant to the more general aspects of development the educator is concerned with; moreover, these topics are more closely related to special education, physical education, and school health programs.

Consideration of both the *Zeitgeist* and the trends of current research demanded that greater emphasis be placed in this issue on learning. Coverage within the field of learning, however, was restricted to what is generally regarded as the major cognitive aspect of classroom learning, namely, *meaningful* kinds of cognitive learning. It is true, of course, that some classroom learning, such as foreign language vocabulary and the symbols used to represent the chemical elements, approach the rote level, but this type of learning is a very small part of the curriculum. In any case, the associations formed under these circumstances are not wholly arbitrary, as in the learning of paired associates, but involve the learning of representational equivalence, i.e., that particular symbols are equivalent in meaning to already meaningful concepts in cognitive structure.

The kinds of learning reviewed in this issue, therefore, include, for the most part, (a) the meaningful acquisition and retention of information, concepts, and propositions; (b) evaluation; and (c) thinking and problem solving. Also included are the long-term outcomes of school learning, i.e., knowledge of subject matter and ability to use such knowledge in thinking and problem solving. Nonverbal intuitive understanding of re-

lationships and other nonverbal types of symbolic learning are considered, as well as meaningful verbal learning.

Research on rote, noncognitive, and simple discriminative learning was excluded from consideration, first, because the relevance of such findings for classroom learning is at best only indirect and tangential, and second, because their inclusion would have so broadened the scope of the field that coverage would necessarily have become superficial, fragmentary, and unsystematic. It could be argued, of course, and with considerable justice, that relatively few well-controlled studies of meaningful learning have been conducted. The Committee, however, felt that to review systematically the more directly relevant research in the field was preferable to padding the issue with a miscellaneous assortment of rigorously controlled studies of questionable relevance.

By setting the standards of scope, relevance, and significance implicit in this choice of focus and by providing a programmatic model for systematically ordering relationships within this area of knowledge, it is hoped that this issue can influence, as well as reflect, research trends in growth, development, and learning.

DAVID P. AUSUBEL, *Chairman*
Committee on Growth, Development, and Learning

CHAPTER I

Perceptual and Cognitive Development

J. RICHARD SUCHMAN and MARY JANE MC CUE ASCHNER

THIS CHAPTER is devoted to studies in the development of the cognitive processes involved in perceiving, thinking, and learning. It focuses on how and when these processes evolve, the factors that influence their formation, and their effects on the intellective functioning of the child.

Development of the Perception of Physical Stimuli

During the past decade there has been increasing interest in the effects of central and intervening processes on the act of perceiving. The construction of theories and models of perceptual mediation has not been matched by empirical research, however, and a number of exciting hypotheses have been put forward that are still in need of adequate testing. In the absence of any broad, longitudinal studies, several reviews will be noted before empirical investigations are discussed.

Wohlwill's (1960a) analysis was limited to experimental investigations involving noncognitive, nonconceptual tasks. A decrease in the perceptual assimilation of objectively different stimuli was noted as a correlate of increasing age, while the distorting effects of contrast were found to increase. Apparently, as the child becomes better able to discriminate, the very contrast between the differentiated stimuli of which he has become newly aware serves to produce distortions. This suggests a growing relativism and a corresponding reduction in the importance of the absolute properties of the stimulus. Other trends noted by Wohlwill were a tendency, increasing with age, to relate a stimulus to its spatial framework and a sharp drop in errors of spatial localization of body orientation. In all instances the improvement of perceptual discrimination was accompanied by the onset of centralized controls, which stabilized and simplified perceptual patterns, sometimes at the expense of objectivity (veridicality). The need for this simplicity can be inferred from another trend identified by Wohlwill, who noted that the young child requires more redundancy in a pattern to perceive it correctly and prefers perceptual modes that provide a minimal scope of information. The question of whether or not age, learning, and the emergence of central controls and regulatory mechanisms actually increase veridicality was singled out as the most significant open question to be faced.

Bevan (1961) posed a theory of the evolution of perceptual frames of reference that was founded primarily on differentiation rather than association. He pointed out that perceptual development is characterized by pro-

gressive refinement, definition, and specificity rather than a building up of associative links.

Pastore (1960) stated his bias unequivocally: "All the significant aspects of perceiving are unlearned." He pointed to the perceptual similarities between man and lower animals, which exist "despite obvious differences in anatomical structures and in modes of responding to the environment." Among the modes cited were the perception of form, depth, apparent movement, illusion, size, and brightness constancy. Pastore noted that the extremely early onset of many perceptual modes almost ruled out the possibility of perceptual learning. He allowed that both learned and unlearned perceptual behavior may play a role in development, but argued that "at most, learning factors must be assigned a secondary role; they may exert an influence only when the perception-to-be-modified is already an existent one."

The three reviewers agreed that early perceptual development is chiefly a function of maturational change and the increasing capacity to differentiate stimuli. But from this point on they diverged. Wohlwill stressed associative learning and perceptual integration; Bevan, dissociative learning and perceptual differentiation; and Pastore, neurological maturation and preformed perceptual patterning. Unfortunately, none of the reviewers was concerned with the perception of stimuli which have strong links to conceptual and value systems, despite the fact that perceptual growth is ordinarily interwoven with conceptual growth. Where stimuli have been abstracted from a meaningful context, the act of perceiving may be deprived of certain conative and other conditions that normally influence the shaping of a percept.

Role of Stimulus Properties

Developmental studies of form perception have persistently produced the disturbing finding that common objects, though highly complex in form, and irregular abstract forms (Piaget called them "topological") are invariably perceived and discriminated more readily by young children than were Euclidian shapes. Page (1959), in a replication of an earlier study by Piaget, found new confirmation for the "primacy of topology": preschool children were nearly three times as successful with haptic recognition (feeling cutout forms without seeing them) of topological forms as of simple geometric shapes such as squares and triangles. He offered three hypotheses: (a) Identification of topological forms requires more primitive neuromuscular actions than do more regular shapes. (b) Geometric forms are less frequently found in nature and thus are less familiar. (c) Such topological qualities as closure, separation, proximity, and continuity provide immediately available perceptual cues for the younger child who has not yet mastered the essentially logical relationships found in Euclidian forms. The familiarity hypothesis seems the most parsimonious, and it was

supported by evidence of early recognition of common objects regardless of shape.

Gibson and other researchers found, on the other hand, that for some types of perception familiarity with stimuli was totally unnecessary. Gibson and Walk (1960) ascertained that most terrestrial creatures were able to identify and avoid an abrupt drop-off, or "visual cliff," without prior experience. The subjects were placed on a glass runway which afforded two exits. One exit was reached over a sharp drop visible through the glass and made more apparent by a textured pattern directly under the runway which was identical to that at the bottom of the "cliff." The alternative exit was shallow. All animals capable of locomotion, including the infant, favored the shallow exit significantly more often than the "cliff." These findings supported the existence of at least some degree of preformism in perceptual discrimination.

To test the saliency of the perception of "depth-at-an-edge," Walk and others (1959) exposed rats from birth to three-dimensional cutouts of geometric forms mounted inside their cages. For control animals the same forms were painted on rectangular panels. At maturity, the rats familiar with the three-dimensional forms performed significantly better than did the others in learning tasks requiring discrimination among the forms. This was interpreted as additional evidence of the primary perceptual saliency of "depth-at-an-edge." Stevenson and McBee (1958) obtained similar results with four-year-old and six-year-old children, who learned to discriminate stereometric objects and patterns more rapidly than planometric.

If certain properties of visual stimuli make some stimuli more noticeable than others, what are these properties, and what is the source of their saliency? To find answers, Gibson (1961) asked four-year-old and eight-year-old children to match a standard printed symbol with its mate, which had to be selected from 11 similar symbols, each of which differed in one feature from the standard. To the extent that selecting the appropriate mate was easy, the feature that had been varied was regarded as distinctive. Error curves dropped sharply from the four-year-olds to the eight-year-olds in discrimination of all features, although the shapes of the error curves differed considerably, because certain features were consistently more distinctive than the others.

Graham, Berman, and Ernhart (1960) found no support for Werner's hypothesis that the distortion of perception of younger children toward excessive closure, simplicity, and symmetry decreases with age. They analyzed preschool children's reproductions of simple geometric forms and concluded that the properties of the stimulus itself probably were more closely related to the amount of perceptual error than was the age of the child. However, since perceptual variables were inferred from the children's drawings and since motor performance variables were not controlled, these results should be interpreted with some caution.

It was evident in these studies that very early in development, perhaps too early for learning to have occurred, the organism perceived different

cues with varying degrees of sensitivity. Apparently, in some instances, certain objective properties of a stimulus innately augmented its saliency. In other instances, however, early exposure to particular stimulus forms rendered the organism more sensitive in the discrimination of these forms. These facts have obvious significance for education, particularly with regard to readiness for learning.

Role of Central Processes

The regulatory mechanisms governing perceptual constancy in the judgment of size and auditory localization were also examined for developmental trends. Cohen, Hershkowitz, and Chodack (1958) found that younger subjects were either less certain or more diffuse than older subjects in their judgments of the comparative size of two stimuli. Judgmental accuracy of older subjects increased in relation to that of younger subjects as direct visual comparisons were made more difficult. It was concluded that the development of size constancy was a critical factor. Similar findings were obtained by Liebert and Rudel (1959) in their study of auditory localization under body-tilt conditions. Blindfolded older and younger subjects did equally well in localizing a sound source, but when the body axis was tilted, the older subjects overcompensated more than the younger ones in their localization judgments. One may again note the increasing control exercised by central processes with increasing age, particularly when data are scant, ambiguous, or contaminated by interference.

London (1958) presented normal and maladjusted boys aged 4 to 15 with picture cards portraying a gradual transformation of an initial figure into another markedly different one. Among the normal boys, the older subjects made more appropriate discriminations of changes in the card series than did the younger ones. Among the maladjusted boys, the effect of age on discrimination was not as clear, and they made both earlier and later generalizations from perceived shifts than the normal boys did. London's interpretation was that maladjusted children generalized more than normal children and that they made both premature and delayed generalizations. Two corollary principles were that the development of normal generalizing was toward a balance between much abstraction from little data and little abstraction from much data and that the mechanism that maintained this balance was related to socioemotional adjustment.

Ames's (1960) longitudinal study of *Rorschach* protocols for subjects aged 2 to 10 showed a steady decline with increasing age in the objective use of form and detail as organizing stimuli, in sharp contrast to steadily increasing scores on every other major variable. Here was evidence of the increasing subordination of external stimuli to the control of central processes in the determination of meaningful perceptions. But this trend was only part of the picture. Set was apparently a critical factor. London's (1958) subjects approached objectivity through greater discrimination with

increasing age, while Ames's moved in the same direction through increased central organization and control. In the first instance, the set was to make discriminations; in the second, it was to react in an undefined way to a stimulus.

Development of the Perception of Social Stimuli

The act of making social judgments involves more than simple perceptual discriminations. The data available to the perceiver are often sketchy and ambiguous in relation to the judgments he makes from them and leave considerable room for organization and inference. Gollin (1958) analyzed the social judgments of children aged 10 to 17 about a fictitious child portrayed in motion-picture vignettes. The developmental trend was toward the increasing use of inference (going beyond the actions shown in film) and concept (accounting for diversity of behavior in a single explanatory system). Inference came into use earlier than concept, but both occurred relatively late. At age 10, only 18 percent of the boys and 21 percent of the girls used inference, and 2 percent of all subjects used concept.

Jahoda (1959) probed the development of social-class discrimination, using an interesting picture-matching technique to assess the ability to group people on the basis of social-class symbols. The trend from 6 to 9 years of age was from early global subjective judgments to increased utilization of specific objective indexes. Both perceptual discrimination and learning were seen as determinants of accuracy.

Picture-card sorting, doll assembly, and story completion were used by Stevenson and Stewart (1958) to study the development of the perception of racial differences. White and Negro three-year-olds had difficulty making racial distinctions, but by the seventh year almost all subjects could discriminate easily.

The most striking aspect of these studies of social perception was the relative lateness in development at which the objective interpretation of social data began to displace subjective social judgments. Because of powerful ego-related (subjectivistic) central controls and the scarcity of unambiguous data, social perception probably never reaches the levels of veridicality achieved in physical perception.

Development of Intelligence

Recent studies of mental growth tended to emphasize increasingly the qualitative aspects of intelligence. This shift, no doubt, reflects the spreading influence of the theories of Piaget and Guilford, who have focused on the *process* of thinking rather than the *potential* for it.

Operational Intelligence

Inhelder and Piaget (1958) and Piaget and Inhelder (1959) set forth the results of 20 years of intensive study of the growth of logical thinking.

The behaviors of nearly 3000 children aged 2 to 16 were examined as they performed a variety of problem-solving tasks. Elementary logical structures were traced from their origins in infancy through the period of transition (around adolescence) from concrete to abstract and formal logical thinking. The studies used the now familiar clinical method that involves interviewing the subjects at work on a task. The aim was to obtain increased insight into cognitive acts from the child's own verbal reports.

The dominant changes with growth were toward both a desubjectification of thought and an increased co-ordination and purposeful direction of it. Children were found, with increasing age, to remove themselves from total immersion in their cognitive world to a position outside it, from which they could experimentally manipulate variables and perform heuristic operations. These operations were seen as steadily approaching the structure of formal logical systems.

Inferences about each subject's level of cognitive functioning were drawn directly from the interview protocols, but the criteria by which responses were assigned to one level or another were not always clear. The reader was expected to accept the authors' interpretations of the data, since selected protocols were given only as illustrations of the authors' formulations. The extent to which the data actually justified the formulations could not be ascertained.

The lack of normative data all but obscured the fact that Piaget and Inhelder found differences in the modal age of children at a given stage on two different tasks. Apparently, the age level for the attainment of a given stage was task-specific rather than general, and a child could operate at stage 1 on one task and at stage 2 on another. By imbedding their findings in lengthy and ponderous discourses and failing to present their data systematically, the authors left themselves vulnerable to such misinterpretations as the belief that they had constructed a rigid age-scale of cognitive development.

Between the major operational stages, Piaget and Inhelder found it necessary to insert many transitional stages which weakened the argument for discontinuous stages. The trends, rather than the stages of cognitive organization, seem to be the more defensible hypotheses to emerge from the studies. Longitudinal studies would have provided a far better test of the hypothesis of discontinuity, in that qualitative shifts could have been observed rather than inferred.

Creative Intelligence

J. P. Guilford and his associates' tests tap such factors in creativity as ideational fluency, spontaneous flexibility, and originality. Using adaptations of Guilford's instruments and a few of their own design, Torrance (1961) and his associates charted the development of creative abilities through the elementary-school grades. Children in rural and urban schools and in public, private, and parochial schools were tested. Everywhere cre-

ativity increased steadily through grade 3, dropped off sharply in grade 4, gained slowly in grades 5 and 6, and made another, slighter dip in grade 7. The same pattern was seen in the fluency of question-asking on the "ask-and-guess" test but not in the formation of hypotheses. In all cases, it appeared that the "fourth-grade slump" was characteristic of divergent and creative activity but not of convergent problem-solving performance.

While this puzzling pattern may have indicated the presence of discontinuous shifts or stages in the development of creative abilities, too little was known about the instruments to draw any conclusions. Torrance reported on plans to continue the investigation of this phenomenon using a broader measurement base.

Development of Concept

Most recent studies on the growth of particular concepts reflected Piaget's influence. They were efforts to test or confirm his findings, to apply his theory to new kinds of concepts, or to employ new methods of mapping concepts he had explored.

Mathematical and Physical Concepts

Wohlwill (1960b) studied the ordered sequence of developmental changes in the child's concept of number. By scalogram analysis, he sought, through a behavioristic interpretation of symbolic processes, support for Piaget's findings. Subjects worked problems designed to elicit "conceptual response to the dimension of number at progressively more elaborate levels of symbolic mediation." His findings confirmed Piaget's. More significantly, Wohlwill concluded that the abstract concept of number arose mainly in the child's cumulative general experience and that its course was affected little or not at all by specific practice with numbers, as in counting.

Lovell (1959) and Lovell and Ogilvie (1960, 1961) attempted to test Piaget's findings on the emergence of conservation—of the child's awareness that "X is constant regardless of factors A, B, and C." They repeated his "experiments" on the conservation of substance and weight and devised some of their own, but they admitted failure to test his claim that, once the child reasons logically in concrete situations, conservation may be inferred. This failure may have stemmed from the authors' shaky hold on Piaget's logic. Also, their failure to specify definitions—his or their own—of "conservation," "reversibility," and other key terms casts doubt on the validity of their findings. Nevertheless, given benefit of the doubt, their findings merit attention.

Lovell (1959) confirmed Piaget's developmental stages, but Lovell and Ogilvie (1960) found, contrary to Piaget, that substance is *not* conserved for all time upon attainment, but is conserved only in very specific kinds of situations at first and then expands to others with experience and matura-

tion. Lovell and Ogilvie (1960, 1961) also pointed out clearly the problems of interpreting what children mean or understand in conversation. They noted that adult-child communication was hampered not only by much verbal confusion in children under 12 but also by the very disparate conceptual systems through which adult and child viewed the things and events which they referred to by the same words.

Annett (1959) compared and analyzed groupings and explanations made by 303 children aged 5 to 11 and 42 adults aged 18 to 73 in classifying common objects. The main developmental changes were in methods of explanation, which were related to both IQ and age. She concluded that her findings supported the "dispositional view of concept formation," held by Piaget and others, "in its implications that concepts may be attained through stages not apparent upon consideration of their final form in adults."

Moral Concepts

Durkin (1959a, b; 1961) tested Piaget's claim that reciprocity (an eye for an eye) as children's basic principle of justice holds firm with age, but with growing concern for equity. Attempting careful cross-cultural matching, she interviewed American subjects about hypothetical episodes of physical and nonphysical aggression. She concluded that Piaget's findings, derived only from situations of physical aggression, could not be generalized; that he minimized environmental effects upon ideas of justice; and that his assertion that a concept of "justice" grows in proportion to peer contact, independent of adult influence, was invalid.

Jahoda (1958a, b, c) studied West African children's moral concepts. He disproved Piaget's prediction that animism, as reflected in concepts of immanent justice, would persist to higher age levels in primitive societies than among more civilized peoples. In a critical survey and criterion study of cross-cultural research, he concluded that Havighurst and Neugarten were in error in their confirmation, based on Hopi Indian children, of Piaget's prediction.

Social Concepts

Danziger (1958) interviewed 41 Melbourne school children aged 5 to 8 on their notions of "rich" and "poor," on the uses of money, and on the role of "the boss" at work. He found Piaget-type stages in the development of concepts of economic relationships. Allowing for cultural bias, he concluded that the parallel findings between this study and an earlier study on concepts of kinship "raise the possibility that there may exist some truly general features in the growth of social concepts."

Development of Thinking Processes

Productive studies on the development of particular kinds of thinking focused mainly on language and association processes and on physical and

quantitative reasoning. Piaget's influence was directly evident only in the latter area.

Brown and Berko (1960) gave 60 children in grades 1 to 3 and 20 adults at the Massachusetts Institute of Technology a word-association test in which nonsense stimulus words were associated syntactically. Results confirmed the hypothesis that in language development, "syntactic similarity becomes an increasingly important determinant of word association." Thus the child who once associated nouns with adverbs as in "rain—hard" or "street—wet" eventually matched nouns with nouns, as in "rain—sleet" or "cat—dog." The authors concluded that "it seems certain that homogeneous scores for free association are related to homogeneous scores for usage."

Braine (1959) made a rigorously formal critical examination of Piaget's theory on the development of thinking processes involved in measurement and in the discrimination of order. He found that the child's attempts at linear measurement may reflect his knowledge of measuring techniques as much as it does his ability to reason logically about length. This finding rendered questionable Piaget's diagnosis of the child's ability to make inferences basic to measurement solely on the basis of his performance in measurement tasks. Braine also found that reward, sex, and previous experience in ordering tasks were unrelated to success in measuring. His one *gaffe* was his interpretation of Piaget's age citations as age stipulations; consequently, he erroneously ascribed to Piaget the claim that "the ages of transition are, in themselves, genetically predetermined."

Mogar (1960) confirmed Piaget's stages in the growth of the child's concept of physical causality. For her younger subjects (under eight years), experience in causal reasoning "seemed to have positive effects"; it follows that the development of certain reasoning processes may well be subject to educational acceleration.

Elkind's (1961) systematic replication of Piaget's study on the development of quantitative thinking resulted in confirmation of Piaget's "age-related hierarchically ordered stages of success in comparing quantity." Subjects were given beads, sticks, and liquids to consider in their assessments of quantity. Elkind, in referring to the use of general quantitative terms such as "number and amount," hinted at a possible weakness in his and Piaget's studies: "Because of this ambiguity of language, it was assumed that the verbal directions did not provide clues to the types of quantity that had to be compared."

Development of Learning Abilities

Meaningful learning and the build-up of conceptual systems rely heavily on the formation of associations. There were two investigations into factors related to the development of associative learning. Bousfield, Esterson, and Whitmarsh (1958) used a word-list recall task to determine the amount of associative clustering and the preferred basis for clustering (color *versus*

function) used by children between third grade and college. The finding that older subjects manifested a greater amount of conceptual clustering and better recall than did younger subjects suggested increasing integration of cognitive structure with age. Contrary to the authors' predictions, the use of color did not decrease with age as a sorting criterion. It was concluded that color is a highly complex determinant of responses and that its effect on the child's mode of associative clustering could not be analyzed independently of other determinants. The authors further suggested that the basis for any associative clustering might well be a function of the alternative bases for judgment available at the time the association is made and that attitudes or sets might have an appreciable influence.

In a study of paired-associate learning by Akutagawa and Benoit (1959), age was found to be a far more significant factor than IQ in the ability to learn very simple associations, although the importance of intelligence did increase as the learning task became more complex. Support was seen in these findings for Hebb's theory that lower levels of associative learning are determined more by the gross amount of previous experience than by intelligence. The ability to form new associations, like so many other cognitive abilities, seems to develop as a function of experience, probably because experience expands the cognitive structure which, in turn, facilitates the learning of new associations. While Hebb's theory regarding the environmental shaping of neurological structures and functions has yet to receive clear empirical support, one can make a convincing case for the importance of experience as a determinant in the growth of learning ability. Hunt (1961) has made just such a case in his extensively documented synthesis of Hebb's and Piaget's empirically derived formulations.

Dissociation also is a kind of learning, and the ability to make appropriate semantic differentiations among dissimilar but related concepts apparently depends on how related the concepts have become in the course of the child's experience. Ervin and Foster (1960) found that dimensions such as size, weight, and strength and social attributes such as those described by "good," "pretty," and "clean," which are learned as correlated variables long before the child can clearly differentiate them, become so linked with each other semantically that the concepts they represent remain very difficult for the child to keep distinct. This seems an important phenomenon for further study. It may well be that conceptual structures growing out of early empirical experiences influence the entire course of subsequent language development.

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CHAPTER II

Personality and Social Development: Family and Peer Influences

JEROME KAGAN and HOWARD A. MOSS

RESEARCH in personality development during the past three years was concentrated on a more manageable number of variables. Areas of particular concentration were (a) the motive-related responses of aggression, dependence, achievement, and sex-role identification and (b) the effects of parental control, affection, and personality on the development of the child's needs and patterns of social interaction. The influence of the peer group was also given consideration. This chapter will begin with a consideration of the research in the long-term stability of selected behaviors and will continue with a discussion of the influence of parents and peers on the behavior of the child and the adolescent.

Stability of Behavior

Although major longitudinal studies on developmental stabilities in personality have been in progress for more than 25 years, findings have only recently begun to appear. A book by Stone and Onqué (1959) contained an annotated bibliography of longitudinal studies. Tuddenham (1959) reported on investigations at the University of California's Institute of Human Development which assessed the stability of selected behaviors from adolescence to adulthood. Irritability and ease of anger arousal in adolescents, assessed by observations and interviews, predicted interview ratings of similar response tendencies for men but not for women. Social anxiety, on the other hand, was stable from adolescence to adulthood in women but not in men.

A second longitudinal study of stability, by Kagan and Moss (1960), involved 71 subjects of the Fels Research Institute who were observed as children (from birth to age 14) and interviewed and tested as adults. Ratings of childhood behavior were then correlated with independent ratings of adult behavior for selected personality dimensions. Girls who were highly dependent on their mothers during ages 6 through 10 were highly dependent on their families and husbands as adults. Dependent behavior was not stable for males. The authors suggested that dependent behavior violated sex-role standards for males and that dependent boys learned to inhibit this behavior as they matured. A dependent posture was more congruent with traditional female sex-role standards, and the dependent girl was not highly pressured into inhibiting this response.

A short-term study of personality development during the first five years, reported by Thomas and others (1960) and Chess and others (1960), suggested that passivity in the preschool child may have its historical roots in behavior displayed during the first year of life. One hundred and ten children were studied continually from birth through age 5, primarily through interviews with the mothers at three-month intervals during the first year and semiannually thereafter. The authors postulated nine primary reaction patterns in the infant (including motor activity, passivity, perceptual thresholds, and rhythm in sleeping and feeding cycles) and concluded that the child's behavior at age 2 was derived, in part, from infantile reaction tendencies, with passivity a critical characteristic during the first year. Unfortunately, there was no detailed presentation of the statistical relationships between each of the infant behavior categories and aspects of the older child's behavior.

Escalona and Heider (1959) attempted to predict the behavior of 31 preschool children (aged 3 through 6 years) from observations made during the first eight months of life and from some knowledge of their parents. The predictions were most accurate for (a) degree of adoption of traditionally sex-typed traits, (b) motor development and co-ordination, and (c) capacity for attention and concentration. Predictive accuracy was poorest for (a) behavior in unfamiliar situations or with unfamiliar people, (b) competitiveness, and (c) quality of relationship with the mother. Unfortunately, the significance of these results is equivocal, since the accuracy of the predictions of preschool behavior from infancy behavior was evaluated by the person who made the original predictions.

Mussen (1961) suggested that the degree of adoption of traditional masculine or feminine sex-role interests among adolescent boys was stable over a 15-year period and had interesting derivatives in adulthood. Approximately twenty 17-year-old boys were identified at each extreme of a group of 68 arranged in order of their masculinity-femininity scores on the *Strong Vocational Interest Blank*. Administered the *California Psychological Inventory* in their early thirties, subjects with highest feminine-interest scores as adolescents were found to score higher as men on scales purporting to measure (a) nonmasculine interests, (b) dominance, and (c) capacity for status.

In an investigation of the stability of maternal behavior by Schaefer and Bayley (1960), a mother's behavior during the first three years of the child's life was related to her attitude during the child's adolescence. The early data were based on observations of mothers and children during testing sessions; the follow-up data were based on interviews with the mothers when the children were between 9 and 14 years of age. Love-hostility ratings were moderately stable over this period, whereas autonomy-control ratings did not show continuity. It was unfortunate that the authors pooled the data for the sexes, since these dimensions may have been differentially stable for boys and girls.

The last three years witnessed a dramatic increase in studies on the long-term stability of behavior. The data, though often meager and unsystematically collected, suggested that measures of selected behaviors of school-age and adolescent children often were predictive of adult functioning, especially when the behavior in question was congruent with traditional sex roles.

Additional References: Bronson, Katten, and Livson (1959); Durrett (1959); Kagan and Moss (1959b); Rheingold and Bayley (1959).

Family Influences on Personality Development

The delineation of two primary dimensions of maternal behavior—love *versus* hostility and autonomy *versus* control—was one of the important advances in research in parent-child relations. Schaefer (1959), analyzing ratings of maternal behavior from a variety of sources with the Guttman circumplex scheme, found these two independent dimensions emerged consistently from his analyses. Schaefer's conclusions were supported by the analyses of Becker (1960) and Milton (1958). The implication was that either these two dimensions are, indeed, the primary variables in the mother-child relationship or psychologists have great difficulty seeing or conceptualizing other aspects of maternal behavior. An excellent summary of methodological issues and findings in the study of parent-child relations appears in a chapter by Hoffman and Lippitt (1960).

Correlates of Love-Hostility and Autonomy-Control

Research in which parental practices and attitudes were correlated with the child's behavior included that of Burchinal (1958), who administered the *Porter Parental Acceptance Scale* to the mothers and fathers of 256 fifth-graders. The mothers made higher acceptance scores than the fathers, but there was no evidence of differential treatment of boys and girls. In other studies, by Emmerich (1959a, b) and Kagan and Lemkin (1960), controlled questioning of children revealed that both boys and girls perceived the mother as more nurturant than the father.

Trapp and Kausler (1958) investigated the relationship between parental dominance (as measured by a questionnaire) and the quality of the child's interaction with adults in a nursery-school situation. The children of parents scoring very high or very low on the dominance scale showed greater avoidance of adults in the nursery school than did the children of parents who scored in the intermediate range.

Peck (1958), studying 34 adolescents, correlated four dimensions of family interaction—consistency, democracy, trust and approval, and severity—with six trait clusters—ego strength, superego strength, willing social conformity, spontaneity, friendliness, and hostility-guilt complex. Those adolescents with high ego strength (i.e., mature, rational, possessing insight

into others' motives, and inner-directed) had parents who were consistent, trusting, and approval giving. Adolescents who felt guilty because of hostile feelings came from autocratic families.

In related studies, Antonovsky (1959) associated maternal restrictiveness with aggressive behavior in the child. Fathers with strict and punitive attitudes tended to have children who were aggressive (Marshall, 1961) or had behavior problems (Peterson and others, 1961). In the latter study, paternal attitudes were found to be more predictive of maladaptive behavior in children than were maternal attitudes. Becker and others (1959) interviewed parents of normal and disturbed children and found that arbitrary and authoritarian maternal attitudes were correlated with the presence of conduct problems in the children. The presence of excessive shyness and timidity in the child was associated with paternal maladjustment and frustration of the child's autonomy.

In a more comprehensive investigation, Sears, Maccoby, and Levin (1957) interviewed 379 mothers of five-year-old children in the Boston area. The mothers were questioned about their feelings toward motherhood, their child-rearing practices, and their children's behavior. The interviews focused on the developmental areas of feeding, toilet training, dependency, sex, aggression, and conscience development. The specific findings of this project were too numerous to summarize in detail. The data clearly indicated the importance of maternal warmth and affection. Lack of maternal warmth was associated with feeding problems and difficulty in toilet training. Moreover, the course of socialization training was highly dependent on the bond of affection between mother and child, for specific socialization practices had different effects depending on the strength of this bond. Finally, maternal punishment of undesirable behavior did not appear to be an effective method of eliminating the behavior, and severe physical punishment was associated with aggression toward the parents and retarded superego development.

Results from a study by the Fels Research Institute support the latter conclusion. Crandall and others (1958) measured social compliance among a group of nursery-school and early school-age children in a free-play situation and in the home. Ratings of the mothers on their reward of a child's compliance and their punishment of noncompliance were based on interviews and observations. Maternal reward of compliance was a much better predictor of the child's compliance outside the home than was punishment of noncompliant behavior. Thus, the finding by Sears, Maccoby, and Levin (1957) that punishment was not always an effective way of eliminating undesirable behavior was supported by evidence from this independent population.

Social Class, Parental Practices, and the Child's Behavior

Severe control, or, as Hoffman (1960) termed it, unqualified power assertion, was studied in 12 middle-class and 10 working-class families with

preschool children. Lengthy interviews with the parents yielded measures of power assertion which in turn were correlated with the child's behavior as observed in a group situation. The working-class parents were generally more power assertive than the middle-class parents, and the mothers who reacted to the children's disobedience with power assertion had children who tended to be hostile and dominant with peers.

The suggestion of an inverse correlation between socioeconomic class and intensity of punitive and dominant parental practices was supported in part by the work of Bayley and Schaefer (1960). Ratings of maternal behavior toward children during their first three years (based on observations) and again at age 10 (based on interviews) were correlated with social class. There was a positive relation between maternal warmth and socioeconomic class and a negative relation between dominance and control and socioeconomic class, with the suggestion of a closer relation between socioeconomic class and maternal behavior toward children during the first three years of life.

Miller and Swanson (1958) interviewed more than 500 mothers of children ranging in age from infancy to 19 years. The families were categorized according to socioeconomic class and rated on a new bureaucratic-entrepreneurial employment dimension (bureaucratic—father employed in a large organization *versus* entrepreneurial—father self-employed or employed in a small organization). The bureaucratic families, which tended to have more formal education than the entrepreneurial ones, were less concerned with teaching self-control to the child, and bureaucratic mothers were more permissive than entrepreneurial mothers.

Socioeconomic-class variables were also implicated in a study by Ferreira (1960) of antecedent correlates of neonatal behavior. Two scales, one assessing fear of harming the baby and the other assessing rejection of pregnancy, were administered to mothers in the last month of pregnancy. The infants were subsequently assessed for deviant behavior with respect to sleep, crying, and irritability during the first five days of life. More of the deviant babies than of the other babies had mothers who scored high on fear of harming the baby. However, the mothers with these high scores had less education than the mothers with low scores. Thus, the neonate's deviant behavior may well have been a function of socioeconomic-class variables not assessed by the investigator.

In summary, there appeared to be a relation between the child's behavior and the maternal love-hostility or autonomy-control dimensions. However, these maternal attitudes were, in turn, associated with socioeconomic-class membership. This makes interpretation of the former correlation difficult, since it is always possible that other variables, related to socioeconomic class but not assessed by the investigator, were the critical antecedent factors.

Additional References: Burchinal (1958); Clifford (1959); Durrett (1959); Gardner, Hawkes, and Burchinal (1961); Garner and Wenar (1959); Gordon (1959); Hoffman (1961); Kagan and Moss (1959a);

Mosher and Scodel (1960); Moss and Kagan (1958); Ourth and Brown (1961); Pease and Gardner (1958); Siegel and others (1959); Smith (1958).

Influence of Parental Reward on Related Goal Strivings

It is generally assumed that direct reward or encouragement of a specific act in a child increases the probability of its reoccurrence. Crandall, Preston, and Rabson (1960) assessed different forms of achievement and dependent behavior in the child, by observations in the nursery school and at home. The mothers of the children were independently rated for frequency of reward for the acts under consideration and for degree of affection toward the child. There was a positive correlation between maternal reward of the child's seeking of approval for completion of a task and the child's striving for achievement, in both the home and nursery-school settings. Moreover, independent behavior displayed by the child with his mother was positively correlated with dependent behavior in the nursery school.

Rosen and D'Andrade (1959) administered problem tasks to boys 9 through 11 years old in their homes while their parents watched and interacted with them. The mothers of boys with high need to achieve (as measured by the *Thematic Apperception Test*) were warmer toward their sons than mothers of sons with low need to achieve. Sons with high need to achieve had been given more autonomy by their fathers. The authors indicated that parents of boys with high need to achieve tended to be more competitive, to show more involvement with their sons, and to take more pleasure in the problem-solving experiments. Thus, parental concern with achievement, in a context of affection, facilitated the development of this motivational system.

Effects of Separation from the Family

Unusual deprivation of maternal nurturance has been assumed to be of importance in later development, and much has been written about this variable during recent years. Bowlby (1960) placed great importance on separation from the mother between ages 1 and 3 and described three phases —protest, despair, and detachment—through which the child passes after separation from a regular caretaker. Lynn and Sawrey (1959) reported that second-grade and third-grade boys separated from their fathers (who were Norwegian sailors) showed greater insecurity and stronger strivings for a father identification in a doll-play situation than normal control children.

Finally, investigations of children raised in Israeli *kibbutz* groups (Bar-Yoseph, 1959; Rabin, 1958, 1959) suggested the presence of diminished hostility toward the family but signs of immature ego development in such children in comparison with those raised in more usual social settings.

Although separation from the mother appeared to have an effect upon the child, the duration of the separation and the presence or absence of mother surrogates were highly significant variables. It is not yet possible to make a generalization about the specific effect of this class of experiences.

Additional References: Marschak (1960); Schaefer and Bell (1958); Schaefer, Bell, and Bayley (1959); Smith (1958).

The Process of Identification

The concept of identification came under closer scrutiny. Although, according to Bronfenbrenner (1960), there was not complete agreement on the motivational processes behind the child's identification with an adult model, many researchers agreed that one of the major signs of a strong identification was the child's adoption of the behaviors, motives, attitudes, and self-conceptions of a model. Kagan (1958) and Maccoby (1959) argued that the salient motive for this process was the wish to possess desirable characteristics of the model; and power, receipt of affection, strength, and competence were suggested as some of the adult qualities that the child desired to possess. In order to obtain these goals vicariously, the child adopted the behavior and attitudes of the parental model.

Additional References: Bronson (1959); Hartup and Zook (1960); Kagan (1958); Mussen and Distler (1959).

Peer-Group Influence

There are substantial methodological difficulties in demonstrating a cause-effect relationship between peer attitudes and changes in a child's behavior. Most investigations, therefore, either correlated peer attitudes toward a child with his behavior or presented descriptions of dominant peer attitudes. Since the desire to be accepted by peers was very strong in most children, it was generally assumed that the child adopted those traits valued by the dominant reference group. A correlation between the values of a particular peer group and the behavior of a child who was a member of that group furnished indirect, but persuasive, evidence for the influence of peer relationships.

Aggression and Peer Acceptance

Researchers noted that a type of behavior often required for peer acceptance was inhibition of aggression. Lesser (1959) used a sociometric technique to assess the relation between popularity and five forms of aggressive behavior in fifth-grade and sixth-grade boys. Popularity was negatively related to the frequency of overt aggression. Feinberg, Smith,

and Schmidt (1958) asked 2400 adolescents of high-income, middle-income, and low-income families to describe the traits that led to acceptance or rejection. All children regarded intelligence, fairness, honesty, and conscientiousness as positive, and noisiness and conceit as negative. Aggression was a frequent basis for rejection among the low-income and middle-income groups, but seemed irrelevant for the children of upper-income families. Goertzen (1959) administered a 32-item opinion scale to 1773 boys and girls in the seventh grade, taking into account the variables of sex, birth order, intelligence, and socioeconomic class. None of these variables was related to the children's answers, and all the children agreed that aggressive behavior was more objectionable than nonconforming or withdrawing behavior.

Marshall (1961) assessed the behavior of nursery-school children both in a role-playing situation and in a realistic context. Frequency of hostile behavior in the role play, but not in the realistic situation, was related to social acceptance for boys but not for girls. Thus, aggressive behavior was socially more acceptable when placed in a context appropriate for the rehearsal of sex-typed behaviors.

Peer Status and Interpersonal Behavior

Zander and Van Egmond (1958) explored the ways in which the popular and high-status (i.e., socially powerful) child interacted with his peers in a problem situation. The authors selected children from the second and fifth grades, who fell into four groups: high-intelligence–high-status, high-intelligence–low-status, low-intelligence–high-status, low-intelligence–low-status. Groups were established in which these preselected subjects interacted with classmates in a problem situation (e.g., guessing the number of beans in a bottle). The boys who were low in both intelligence and status measures were passive in the problem-solving situation. There were no significant behavioral differences among the boys in the other three intelligence-status combinations. Among the girls, low social power was predictive of passivity in the problem situation regardless of level of intelligence.

In a related study, Harvey and Rutherford (1960) measured status and popularity among 405 children in grades 3, 6, 9, and 11 with sociometric devices. In a classroom setting, the children first indicated their preference for one of two similar pictures. Later, the children read a booklet giving the preferences of a high-status and a low-status child and were instructed to indicate again their preferences for one of the two pictures. The results indicated the following: (a) among the children in grades 6 and 11, there was a greater shift in preference toward the picture preferred by the high-status child than in grades 3 and 9; (b) girls were influenced more than boys; (c) children of low status were influenced more than those of high status.

Situational Variables in Peer Interaction

The influence of the situation on group behavior was illustrated in a set of reports on six hyperaggressive boys (Dittmann and Goodrich, 1961; Raush, Dittmann, and Taylor, 1959a, b; Raush, Farbman, and Llewellyn, 1960). The boys were observed in six different settings on two behavioral dimensions (friendly-hostile and dominant-submissive) on two occasions 18 months apart. The major findings were as follows: (a) low frequency of hostile behaviors in eating situations, (b) higher frequency of hostile behaviors in a structured game situation than in free-play settings, and (c) less hostile behavior toward adults during the second set of observations than during the first.

The investigations of peer-group influences discussed above point to the potentially important role of social power or popularity in the course of a child's development of an autonomous or a passive disposition with others. It becomes important, therefore, to discover each of the many factors that facilitate or obstruct peer acceptance. There is reason to believe that physique, membership in ethnic or racial minority groups, and exercise of peer-disapproved behaviors are all relevant variables.

Additional References: Handlon and Gross (1959); Horowitz (1961); Koch (1960); Meyer (1959).

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CHAPTER III

Personality and Social Development: Societal Influences

IRVING TORGOFF *

THE EFFECT on personality development of the radical social changes characteristic of contemporary life was a matter of much concern (Stein, Vidich, and White, 1960) and conjecture but of surprisingly rare empirical effort.

Ecological Variables

Barker (1960) made a theoretical analysis of the effect of the ecological environment on the individual and presented empirical findings. In a study of residents of two communities, he predicted a number of behavioral and underlying personality differences as a function of the difference in the proportion of those actually participating and those who potentially could be involved in various behavioral settings (school, church, factory). The application of ecological concepts to the study of personality development in the underdeveloped nations now undergoing radical social and economic upheaval remains a task for the future.

Gump and Kounin (1960), in a number of ecological research studies in home, camp, and classroom settings, demonstrated the relationship between differences in the milieu stream and the behavior stream of the individual. Another type of ecological approach was illustrated in an earlier study by Kounin and Gump (1958) of the ripple effect on the children constituting the audience when a teacher disciplined a target child. The significance of the ripple effect in wider social settings was not explored. In a nationwide study, Lazarsfeld and Thielens (1958) explored the effects of the tensions engendered during World War II by the emphasis on "loyalty" and "national security." Through interviews, they explored the reactions and professional activities of a representative sample of 2451 social scientists and revealed the presence of a powerful ripple effect. Teachers' apprehensiveness increased in proportion to the number of incidents involving colleagues, regardless of ideological position and despite the fact that the interviewers had not personally experienced difficulties.

* The writer acknowledges with appreciation the bibliographical assistance of Robert D. Pope. Financial support for bibliographical assistance from the Social Research Foundation is also gratefully acknowledged.

School

Analyzing the elementary-school and secondary-school class as a social system, Parsons (1959) outlined the relation of its structure to its primary societal functions as an agency of (a) socialization and (b) manpower allocation. Sexton (1961) presented striking empirical confirmation of the social-class implications of the sorting function of schools. Brim (1958) emphasized the value of the classroom as a research setting for the study of the genesis of deviancy and the effects of various types of social control. The findings and implications of a set of theoretically interwoven studies on the handling of deviancy in classrooms, utilizing the ripple effect paradigm, were described by Kounin, Gump, and Ryan (1961).

Teacher Characteristics

Ryans (1961) reported that observers related pupil *participation* in elementary-school classrooms to flexible, original, democratic teacher behavior, whereas *controlled* pupil behavior was related to systematic, responsible teacher behavior. The differential efficacy of various types of experimentally manipulated influencing techniques used by USAF instructors was reported by Torrance and Mason (1958). Studying instructor method on acceptance of food in a survival kit, the method of grading the men on their participation was found consistently superior to other direct and indirect influence methods. Reed (1961) found that both "warmth" on the part of science teachers and their utilization of pupils' intrinsic motivation, as rated by these pupils, were positively related to their pupils' interest in ninth-grade science. The level of demands made by the teacher in this situation was not a significant variable. From a combination of selected test scores on the *Edwards Personal Preference Schedule* obtained months earlier, Medley (1961) successfully predicted the ability of education students to establish teacher-pupil rapport. An emotionally intense type of teacher-pupil interaction—transference and counter-transference—was analyzed psychoanalytically by Baron (1960).

Classroom and School Characteristics

Lippitt and Gold (1959) found a correlation between various types of classroom socioemotional structures (stratification of those who are looked up to or down on in various ways) and mental health. Coleman's (1961) study was focused on the causes and consequences of the different varieties of adolescent status systems denoting the social climates found in different schools. The author proposed that efforts be made to redirect the whole adolescent culture so that it motivates the child toward goals congruent with those of adult society. Operating from a theoretical base provided by Pavlov and Makerenko, Soviet researchers explored the effect of classroom and extraclassroom *milieux* on motivational, cognitive, and be-

havioral aspects of personality development (Bronfenbrenner, 1961a; Riabkova, 1960; Zhavoronko, 1960).

Wilson (1959) examined the aspirations of boys with similar social origins who were attending schools characterized by different climates of aspiration. He found that, among sons of both professional workers and manual workers, more of those attending middle-class schools than of those attending working-class schools wanted to go to college. Wilson ascribed these aspirations to the influence of "the dominant class character of the high school's student body" and to peer-group norms. Sexton (1961), however, showed that schools in districts different in socioeconomic class differed not only in composition of student body but also in plant and in educational and personnel facilities. Both Wilson and Sexton emphasized the waste of talent resulting from *de facto* segregation by socioeconomic class. The importance of perceived faculty characteristics relative to peer-group norms was reported by Thistlethwaite (1960) in a study of factors affecting the educational aspirations of scholarship award winners.

Mass Media

Two books were published on the effects of television on children. Both were of the mass questionnaire, survey type, supplemented by other measuring instruments. Himmelweit, Oppenheim, and Vince (1958), after studying a sampling from 2000 English children, found that television viewing subtly but consistently influenced the children's outlook on the world and their value judgments; there was no evidence of any consistent effect on aggression or passivity. Fear reactions were related to the extent to which violence was portrayed in realistic and personal rather than stylized fashion. They found that the nature of the child himself was important in determining the impact of television.

Schramm, Lyle, and Parker (1961) also stressed the importance of conceptualizing the impact of television as due to interaction between the characteristics of both television and child in a social setting. They noted that the crucial, irreducible television variable necessary to understand and predict the effects of this interaction was the fantasy-reality dimension. Child characteristics found to affect the interaction significantly were mental ability, internalization of social norms, gratification derived from social relationships with peers and parents, age, and sex. Relationships were found to be complex and dependent upon "a *kind* of television and a *kind* of child in a *kind* of situation."

Bailyn (1959) reported that frequent exposure to pictorial mass media (television, movies, and comic books) resulted in a tendency among boys to classify people in a stereotyped way and to show a more passive and acceptant attitude. This effect was greater among boys with many problems. On the basis of the belief that mass media viewers prefer themes similar to their own basic problems, Emery (1959) hypothesized and found that preadolescent boys interpreted a Western film in terms of a

latent dyadic theme (superego *versus* id; good *versus* evil) rather than an oedipal theme (young male competing with older male for female). Lack of control groups, however, limited the interpretation of the findings. Lövaas (1961) examined the effects of a film apart from the child's personality characteristics and found that exposure to a film containing aggressive content resulted in an *increase* in the aggressive drive of children (measured by bar-pressing responses producing aggressive doll action). Bauer and Bauer (1960) critically evaluated research evidence on the alleged effects of mass media.

Social Class and Ethnic Background

Wide attention was given both to the process by which social class and ethnic background affected achievement motivation and to the role of parents as mediating agents. Strodtbeck (1958) reported on ethnic differences in status mobility as a function of differences in achievement values, beliefs, child-training practices, and family power structure. Values placed on achievement reflected the differential achievement of (a) the two ethnic groups (the difference was attenuated, however, when class level was held constant), (b) the fathers, as indirectly manifested in social-class status, and (c) the sons, as directly manifested in overachievement and underachievement in school. In a psychodynamically oriented study of social mobility using a national sample of adolescent boys, Douvan and Adelson (1958) found different types of motivational patterns underlying mobility strivings.

Pierce-Jones (1959) reported that adolescents with backgrounds of high socioeconomic status were less interested in outdoor and mechanical activities and more strongly attracted to intellectual pursuits than were their lower-status age-mates. An experimental study by Hoffman, Mitsos, and Protz (1958) revealed that material rewards increased the achievement strivings of working-class high-school students to a greater degree than they did those of middle-class students. Reward-induced strivings in tasks evaluating their "ability to think" touched off, in some middle-class students, anxiety responses that lowered the level of their performance. Apparently, middle-class adolescents are attracted to intellectual pursuits; but, as in the case of the moth and the flame, the pursuit may lead to an anxiety-laden singeing. Sarason and others (1960), however, found no appreciable relationship between social-class membership and the degree of test anxiety shown by elementary-school children.

Miller and Swanson (1960), in a theoretical analysis of the impact of social structure on personality, attempted to reconcile psychoanalytic doctrine with sociological concepts. Methods of resolving conflict, moral standards, and styles of expression were viewed as products of experiences in different types of social structures. Social structure, in turn, was conceptualized on the basis of the degree to which the structure encouraged the interdependence of its members, differentiated into entrepreneurial and

bureaucratic settings. Rodman (1959) analyzed the problem faced by the middle-class social scientist or practitioner in understanding working-class behavior.

Parent-Child Relations

The influence of social class on parental values and behavior received both speculative and empirical attention. Bronfenbrenner (1958) analyzed studies of class differences in child rearing over a 25-year period and noted a shift in the direction of middle-class values and behaviors. Bronfenbrenner's ascription of causal significance to the parallel shifts of expert opinion and parental behavior was questioned by Cohen (1961).

Miller and Swanson (1958) viewed recent changes in American child-rearing practices as a function of the shift from an entrepreneurial to a bureaucratic social structure. Their major thesis was that the bureaucratic-entrepreneurial dichotomy, cutting across social-class lines, carried with it characteristic patterns of family structure, values, and outlook on life, as well as characteristic ideas of the means and ends of socialization. A direct study of the effect of these setting-differentiated practices on the child's personality awaits further investigation. A bureaucratic-entrepreneurial analysis can be applied to Danziger's (1960) study of Javanese child-rearing practices. Gold and Slater (1958) found the bureaucratic-entrepreneurial dichotomy to be of heuristic value in distinguishing the power structure and ideology of the husband-wife relationship.

Hoffman (1960) reported on some of the data obtained in a study of the antecedents and consequences of parental influence techniques. Hoffman found that working-class fathers used more power assertions than did middle-class fathers. The lack of class differences between influence techniques of mothers was ascribed to the greater susceptibility to expert opinion by working-class mothers as compared with their husbands. Kohn (1959b) found no class differences in the use of physical punishment, but did find class differences in the conditions calling forth such punishment: working-class parents responded to the immediate consequences of the child's act, whereas middle-class parents responded to the underlying motivation of the act. Torgoff (1961) reported that middle-class children's compliance with their parents' influence techniques was positively related to the greater emphasis parents placed on the achievement-inducing (relative to the independence-granting) component of the parental role; negative but nonsignificant relationships were apparent in a working-class setting. In an earlier paper, Torgoff (1958) described the questionnaire used in the measurement of the two parental role components and reported that middle-class parents, compared with working-class parents, were oriented toward earlier emphasis on both the achievement-inducing and the independence-granting components.

Rosen and D'Andrade (1959) conducted an ingenious field experiment using observations of family interactions around standardized problem-

solving tasks conducted in the home. They explored the relationship between the social class of the parents and their achievement- and independence-"pushing" practices in child rearing. They also studied the relationship between these practices and the achievement motivation of the sons. The possibility that achievement-inducing and independence-granting parental roles were synergistically, rather than independently, operative in their effect on children's motivation was suggested by Torgoff (1960, 1961).

Bronfenbrenner (1961b) speculated on the changes in children's personalities as a function of changes in the child-rearing practices of American parents. He reported that patterns of parental reaction to sex differences in their children varied with social class; working-class parents differentiated their behavior on the basis of the child's sex to a greater extent than did middle-class parents. A similar relation between social class and parental response to sex differences was reported by Torgoff (1958). Kohn and Carroll (1960) found class differences in the sex-role allocation of parental responsibility for both the support and constraint of a child. As a consequence, one would expect the identification problems of middle-class and working-class boys to differ.

Bayley and Schaefer (1960) found that socioeconomic differences were more closely related to the observed behavior of mothers of boys than mothers of girls. Kohn (1959a) reported that middle-class and working-class parents shared a broadly common, but not identical, set of values that they wanted to see realized in their children's behavior. The significance of class similarities and differences in values was discussed by Rodman (1961) in reference to "the lower-class value stretch." According to Rodman, the lower-class person, while not abandoning the general values of society, develops an alternative set of values; values are stretched so that lesser degrees of success become desirable.

Minority Groups

Research from 1943 to 1958 on Negro-white differences in personality was critically reviewed by Dreger and Miller (1960). Morland (1958) found that racial self-recognition is higher for white than for Negro nursery-school children and noted that racial recognition of others does not necessarily determine socially accurate racial self-identification. Ausubel (1958) analyzed the personality development of segregated Negro children as a variant of the more typical course of ego development; he emphasized the difficulty experienced by such children in identifying with adult figures who possess socially defined inferior status. McCord, McCord, and Howard (1960) reported the first longitudinal study examining the hypothesis that the authoritarian or bigoted personality has its roots in the familial environment. As an explanation for the uniformly negative results, the investigators proposed that prejudice in the working class, unlike that in the middle class, is conformist in nature and based on accept-

ance of a generally stereotyped culture, unrelated to specific personality needs or to unique familial environments.

Rosen (1959) compared the child-rearing orientations and achievement motivations, values, and aspirations of six racial and ethnic groups in an attempt to account for the differential rates of vertical mobility in these groups. Although racial and ethnic differences appeared in sons' achievement motivation and value scores, social class accounted for more of the variance. A finding of interest is that although achievement motivation scores for most groups decreased as the class level declined, a reverse relationship appeared in the Jewish group. Coleman (1961) noted a similar finding. The vocational aspirations of Negro mothers for their sons were the lowest in any group in Rosen's sample. Antonovosky and Lerner (1959) found that Negro youths had a higher level of occupational aspiration than did white youths of similar working-class background. The authors interpreted this as a lack of realism, but cautioned against the "dangerous assumption" that Negro youths should be pressured, under the guise of greater realism, toward lower levels of occupational aspiration. The findings of Lott and Lott (1960), in marked contrast to those of earlier studies reporting unrealistically high aspirations among Negro youths, revealed a greater degree of reality orientation in the occupational and vocational plans of Negro than of white high-school seniors. When matched for IQ and parental occupations, Negro-white differences in vocational goals and postgraduate plans tended to disappear.

The desegregation process was examined in a number of studies. The *Journal of Social Issues* devoted an entire issue to desegregation research (Pettigrew, 1959a). Pettigrew (1961) assessed the prospects and direction of potential contributions by psychology to the study of desegregation. Pettigrew (1959b) concluded, in agreement with McCord, McCord, and Howard (1960), that, given strong cultural and situational norms and pressures, the "conformity needs of the individual, outside of any pathogenic personality factor, may account for the prejudiced attitude of many." Heer's (1959) study specified that the ecological setting gave rise to the socioeconomic factors which, in turn, determined the norm to which Pettigrew's Southern subjects conformed. Challenging theories which ascribed anti-Negro sentiment solely to irrational prejudices, Heer's findings supported his hypothesis that the will of white Southerners to preserve segregation was "a direct function of the economic and social gains resulting therefrom" and inversely related to "the guilt engendered by contact with the value system outside the South." Tumin (1958) found that the higher the respondents' social-class status and the greater their exposure to mass media, the more favorable was their image of the Negro, and the greater their readiness for desegregation.

Situational, interpersonal, and intergroup factors in an integrated camp setting were studied in a controlled "natural experiment" in desegregation (Yarrow, 1958). The *Negro Educational Review* (Lloyd, 1961) devoted an issue to student sit-ins.

Role

Brown (1958) presented an analysis of social and developmental forces operative in the converging preferences of both sexes for the masculine role. Findings from a play preference check list for the measurement of masculinity and femininity in children led Rosenberg and Sutton-Smith (1960) to characterize the change in sex roles, not as role convergence, but rather as an extension of female role perception (possibly similar to Rodman's "lower-class value stretch") and a contraction of male role perception. The extent of the effect of sex-role identification was strikingly demonstrated in an experimental study by Milton (1959), who found a positive relationship between masculine sex-role identification and problem-solving skill both across sexes and within a given sex.

Some of the implications of current changes in sex-role patterns were outlined by Hartley (1960). The question of whether the more rigidly defined sex-role differentiation found in lower socioeconomic groups was due to their higher degree of authoritarianism was explored by Johnson, Johnson, and Martin (1961). They found sex-role differentiation unrelated to parents' occupation when classified by socioeconomic class, but did find differentiation when occupation was classified according to the entrepreneurial-bureaucratic dimension. Maccoby (1959) presented a theoretical analysis of the development of role-taking behavior in childhood.

Cultures in Transition

Ausubel (1960) reported on a field study of the effect of acculturative stress, brought about by Westernization, on Maori adolescents. He attributed the ultimate source of Maori-European differences in adolescent development to the Maoris' greater emphasis on task- and group-oriented aspects of attained status as the basis of self-esteem and their lesser emphasis on self-aggrandizing aspects. This emphasis on task- and group-oriented aspects of attained status can also be seen in the family structure and child-rearing practices of rural Javanese (Danziger, 1960). Danziger concluded that social progress would have to be based on an appeal to sources of motivation other than those of individual success and self-aggrandizement. Bronfenbrenner (1961a) described Soviet attempts to create a "new Soviet man," emphasizing the development of a motivational system based on social, rather than individual, rewards and controls. The results of such a total-culture push are difficult to assess; the balance and pattern of consequences raises an even more complex problem of evaluation. Two reports—one, an impressionistic account of a visit (Alt, 1958); the other, an analysis of data obtained from refugees from the Soviet Union (Inkeles and Bauer, 1959)—provided only the most preliminary data on which to assess the impact of Soviet life on the personality of its citizens. The impact of communal life in an Israeli *kibbutz* on personality

development was described by Spiro and Spiro (1958). Yang (1959) analyzed changes that the Chinese Communist revolution made in the structure and function of the family. Hoffman and Wyatt (1960) presented a theoretical analysis of changes in American family size as a function of changes in motivation for reproduction brought about by social changes.

Puerto Rico, undergoing island-wide transformation, was the locale for a number of studies on social change. Back (1958), after studying slum dwellers in different stages of relocation, concluded that disposition for change is a general personality trait. Green (1960) compared Puerto Rican (Spanish) and Jamaican (English) child-rearing practices and personality characteristics and related these to differences in the cultural traditions characteristic of the two islands.

Landy (1959) conducted an intensive anthropological field study of family patterns and child-rearing practices in a Puerto Rican village and compared these to the child-rearing practices Maccoby and Gibbs found in a New England community. Landy concluded that "changes in Puerto Rico will succeed to the extent that they are consonant with the practices, values and needs of the parents and children." The importance ascribed to the role of the family and the pattern of socialization in the stability of cultural change was questioned by others. Manners (1960) suggested that "changes in Puerto Rico—as elsewhere—will come about whether or not these appear consonant with existing practices, values and needs of parents and children." According to Manners, peoples of underdeveloped areas are eager to abandon old interpersonal patterns for new "if the exchange brings with it the measurable advances of a 'higher standard of living.' "

Conclusion

Much of the research reviewed would have benefited from the use of previously obtained base lines by which to assess change. The need for systematic, periodic, extensive assessments of social and personality characteristics cannot be ignored if we are ever to understand the impact of contemporary and future social changes on personality development.

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CHAPTER IV

Aging and Psychological Adjustment: Problem Solving and Motivation

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THE PSYCHOLOGY of aging, the developmental psychology of the adult years, recently made a considerable advance in organization of information. As in the field of child psychology, a comprehensive handbook of the psychology of the adult years became available, *Handbook of Aging and the Individual*, edited by Birren (1959). Its primary objective was to integrate information and explain the manifest changes which occur in the aging individual. In 24 chapters, this collaborative volume reviewed such aspects of the aging individual as sensation and perception, emotions, learning, intelligence, interests and attitudes, and personality and adjustment. A related volume, *Handbook of Social Gerontology*, edited by Tibbitts (1960), took a sociological point of view toward aging, in recognition of the changing nature of a group or society as a function of the age distribution of its members.

Quite different in purpose and scope was a significant volume edited by Kleemeier (1961) on research in the use of leisure. The years both before and after retirement were described and analyzed with insight, and the book held useful and interesting implications on the potential late-life consequences of education. It emphasized a long-range approach to the use of leisure time, either for mental activity or as an expressive outlet. The trend toward intellectual and expressive sophistication in free-time activity will undoubtedly involve more adult education as well as more attention on the part of educators to what happens to the young people they educate. In view of immediate problems in the education of the developing child, it is not easy to keep in mind that the fundamental criteria for judging developmental influences are the long-term outcomes in the adult. Further, the average person in America spends about 12 or 13 years as a student, or less than 20 percent of the average life span. If age 20 is taken as the end of growth, less than one-third of the life span is spent in growing up. Emphasis on the long-term outcomes of education and development is needed, therefore, if only because of the relatively long period of adult life. Teleologically, it might be said that the goal of growth and developmental processes is achievement of the full capacities of the adult state and maintenance of this state as long as possible. But there were few studies relating to characteristics of early and later life. Further, in such studies as there were, the effects of selection in survival pervaded studies of old age. How most people grow old is still a difficult question to answer.

A significant change in the attitudes of society was shown by the dropping of resistance to research on aging and by movement toward a phase of active encouragement. The White House Conference on Aging of February 1961 included three research groups in addition to other groups devoted to particular problems of late life. The conference as a whole indicated confidence that research in aging would benefit society and individuals. This attitude represents a considerable change from the days of Quetelet in the nineteenth century when, according to Birren (1961), the study of aging was regarded as an undesirable, fatalistic preoccupation.

Birren (1960b) reported a considerable increase in research on aging during the past decade. More reports of research on the psychology of aging were published between 1950 and 1959 than in the entire previous history of the field. Further, a prediction was made that the total literature would at least double in the sixties (Birren, 1961). Such a rate of publication would result in a specialization of interests not unlike that in child psychology and would require new library methods to facilitate storage and retrieval of information.

Psychobiology of Aging

As in child development, there was increased interest in higher cognitive processes in the aging adult. Psychological changes of aging continued to be studied with an eye on the concomitant changes in the rest of the organism, particularly the nervous system. A symposium on research on the process of aging in the nervous system, edited by Birren, Imus, and Windle (1959), indicated a considerable gap in knowledge between the gross and microscopic anatomical changes, on the one hand, and behavioral changes, on the other. Because of this gap, caution prevented statements about behavioral consequences of pathological or physiological changes associated with age, although a symposium edited by Shock (1960) described much activity in relating these two fields.

Biologists with mathematical orientation were prone to take probabilistic views of aging or of survival of aggregates of cells or organisms, as in the work reported by Strehler and others (1960), Szilard (1959), and Wolstenholme and O'Connor (1960). Szilard (1959) and others viewed aging largely as a nonspecific process. Unlike development, which they saw as an orderly process, aging in their view is a process of disorganization along many paths for both individuals and species. An opposing view was that aging follows an internal pattern characteristic of a species. A major problem arising from this view was accounting for the evolution of purported control over late-life functions, since it was not immediately clear how selection of postreproductive characteristics could occur. Birren (1960a) suggested, however, that, if aging is closely related to development, then patterns of growth selected in evolution may determine the patterns of aging. While biologists often com-

mented that processes of growth and aging are antagonistic, there was little evidence about the nature or mechanisms of the antagonism.

In contrast with students of physical-biological aspects of aging, psychologists were interested in the survival and life processes of individuals rather than in mere survival totals. Thus, there tended to be a hiatus in thinking and a difference in purpose between those who studied individual differences and those who did not. Difficulties in research stemmed from the fact that many naturally occurring individual differences in human characteristics may not be experimentally manipulated; important aspects of adult life will have to be observed in their natural environmental settings.

As improvements in the physical and social environments of technically advanced countries continued, new or emerging biological and psychological aspects of aging could be seen. According to Hardin B. Jones (1959), in technically advanced countries where longevity increased, women gained more in life expectancy than did men. Thus, in advanced countries widowhood was a major social problem; in less advanced countries orphanhood was a major concern. With more uniform improvement of living conditions in society, it seemed that individual biological factors such as heredity would acquire greater practical significance. Hence, aging had to be regarded as a basic problem requiring an evolutionary approach in its social, as well as its biological, aspects, for as early manifestations of aging became understood and controlled, new manifestations would emerge.

The Individual Organism

Although many biologists (Strehler and others, 1960; and Szilard, 1959) tended to regard aging as a process of random dissolution, they did not deny that as the individual ages there are changes in his thinking, his performance, his feelings in relation to himself and his world, and his behavior in relation to others (Birren, 1959). It was the organization of the age changes which was of theoretical concern. While not all of these changes were seen as related, researchers implied (Shock, 1960) that aging of the individual is to some extent an integrated phenomenon and should be regarded as a joint product of physiological, psychological, and social changes.

The term *adjustment*, used to refer to the final behavioral output of the individual, remained an elusive concept despite its initial attractiveness. The concept of the whole individual was as vague for the adult years as for childhood, and although investigators made obeisance toward the value of studying the adjustment of the whole individual, in practice their research concerned isolated aspects of subsystems of the organism. Gerard (1959), however, suggested that certain phenomena, including aging, appear only at or above a certain level of complexity of organization. He examined the behavioral output of the individual at the top of a

hierarchical organization in which many subsystems provide the necessary conditions for the final output, but do not directly determine its complexity. In Gerard's view, much of the biology of the individual was held to be maintenance biology, necessary but without direct behavioral consequence, and many of the catalogued biological changes of age were without direct behavioral significance. Biological and behavioral flexibility implied a considerable range of autonomy of function, typical of the optimum state of the adaptive adult organism. Capacity for complex behavior could be regarded as one important aspect of a comprehensive view of adult adjustment.

Automation and Aging

Several trends combined to emphasize higher thought processes in the adult, among them contemporary encouragement of training for scientific output and changes in methods of industrial production. Industry was moving rapidly from dependence on handicrafts and psychomotor skills to programed control of machine production. According to Crossman (1960) and Welford (1960), skills requiring dexterity, speed, strength, and endurance were increasingly being taken over by the machine, leaving the manager with a more specialized intellectual role and the worker with a vigilance task. The employee of a highly automated industry apparently controlled output by monitoring a large system and making judgments and adjustments to secure high output at good quality. This required effective communication with other members of the operating group. Welford (1960, p. 59) summarized his analysis of the trends in this way: "Although automatic methods may reduce the immediate part played by human operator, they leave human beings in certain key positions in which the mental load upon them may be heavy and the effects of their actions far-reaching. The human link in the system thus becomes more and not less important than it was before."

Such trends in industry emphasized the need for characteristics usually associated with college or university training. Whether large numbers of individuals could be effectively taught logical analysis, problem solving, and long-term planning and control, divorced from any realistic application as in an industrial situation, remained to be seen. Transfer of training was no new problem for educators, but contemporary trends made it more acute by stress on logical problem solving.

Problem Solving in the Aged

In the tradition of its Greco-Roman ancestry, our culture has nurtured two apparently opposing stereotypes of the aged individual. Richardson (1933) described one type as mentally regressed, perhaps below the level of prepubescent youth, and the other as informed, sagacious, and resource-

ful. These types were not necessarily mutually exclusive: both types could exist within the wide range of individual differences suggested by senile, mentally ill persons at one extreme and intellectually vigorous octogenarians like Bertrand Russell, Winston Churchill, and Herbert Hoover at the other. It was important, however, to determine whether these contrasting characterizations represented the extremes of a continuous dispersion of mental proficiencies or clusters in a bimodal or multimodal distribution. The possibility of bimodality merited explicit consideration because incidental observations implying bimodality had frequently been reported, whereas the rival hypothesis of continuity, though often assumed in statistical tests, had not been adequately confirmed. The failure to evaluate these mutually exclusive possibilities probably reflected the fact that gerontological psychology had not been conspicuously hypothesis directed.

Research on aging appeared, in fact, to be predominantly concerned with vigorously prosecuting a multifaceted search for apparently age-related behavioral defects. In the area of thinking, these were sought almost exclusively through analysis of performance on standardized tests of mental ability, reviewed by Harold E. Jones (1959). Although unconfirmed instances of dissidence occasionally occurred, the results of these investigations displayed an uncommon amount of interstudy agreement: the aged were repeatedly found to perform as well as young subjects on subtests of vocabulary and elementary arithmetic and were repeatedly deficient in their performances on subtests presumably requiring reasoning ability (analogies, block arrangements, and so on). The degree of conviction that would normally accrue from such consensus was seriously weakened, however, by the perplexing ambiguities that attached to the cross-sectional design. Moreover, later developments in this area brought little, if any, improvement.

Norman and Daley (1959), using a selected group of superior older women, confirmed the general findings outlined above. Over an eight-year test-retest interval, in a longitudinal study of 36 pairs of twins, Falek and others (1960) found a statistically unreliable decline in scores on all of six tests including digit-symbol, block design, similarities, and digit span from the *Wechsler-Bellevue Intelligence Scale,* Form I, from List 1 of the *Stanford-Binet Vocabulary Test,* and from a paper-and-pencil tapping test. Thus the results of recent mental testing were consistent with the accumulated findings of the past 40 years and indicated no need for re-evaluation in this area. However, more extensive longitudinal investigation of cognitive functions is still needed.

Since evidence of diminished ability of elderly persons to reason clearly had been provided by the results of mental testing, researchers were encouraged to undertake more detailed investigations seeking first-order explanations of this deficiency. Thus, in a design primarily intended to secure exemplars of logical construction from subjects of various ages, Welford (1958) reported a study by Allan that employed an unstandardized test consisting basically of a set of statements on topics of com-

mon current interest. The total set comprised two complementary subsets, one consisting of mutually compatible members, the other containing only statements that were inconsistent with at least one other member of the total set. The subjects were asked to construct answers to specific questions which required (a) identification of the members of the first subset as compatible statements and (b) derivation of a valid conclusion from this subset. When the replies were evaluated, it was found that a disproportionately large number of aged subjects produced answers inconsistent with the request for logical analysis and derivation; rather, they made comments on the premises and expressed opinions that were quite independent of those embodied in the test statements. They apparently felt free to reject or correct the premises if they believed them to be in error, and their conclusions seemed to be based on attitudes.

In a more elaborate and formal investigation, Friend and Zubek (1958) obtained results which confirmed and extended Allan's findings. The *Watson-Glaser Critical Thinking Appraisal* was administered to some 480 subjects aged 12 to 80. This battery consisted of subtests purporting to evaluate the following a priori components of goal-directed thinking: the ability to (a) draw valid inferences, (b) recognize assumptions, (c) draw deductions from brief syllogisms, (d) weigh evidence, and (e) evaluate arguments. Further differentiation of items into those that allegedly possessed emotional content and those that were allegedly neutral provided a basis for the development of indexes of objectivity and inflexibility of thought. The results were considered to indicate a marked difference between the older and younger subjects in the ability to think critically, and it was believed that this difference could be largely explained by the inflexibility and low objectivity of the older subjects' performances. Thus, by vastly different methods—one subjective, the other employing a larger number—these two investigations arrived at similar characterizations of logicalness in the performance of elderly people. It appeared that the aged tended to evade, when possible, the analysis of logical forms and the evaluation of arguments on the basis of their logical merits, and preferred to base their evaluation and conclusions on what they believed to be the truths involved.

These two studies were primarily product-oriented and reflected the subjects' mastery of the elements of logic.

The two experiments described below were principally process-oriented and reflected the subjects' proficiency in eliciting and integrating information relevant to a chosen objective. Welford (1958) described an experiment performed by Bernardelli in which contrasting age groups of subjects with no previous electrical knowledge were given instruction, including a demonstration problem, on how to identify the terminals of a resistance net. Four boxes, in which the terminals of the demonstration net were connected to external posts in various patterns, were employed as test materials. Given a wiring diagram of the net and an ohmmeter, the subjects' task was to discover how each of the six posts for each of

the four black boxes was associated with the several internal resistances. Elderly subjects correctly identified more terminals per problem, but the difference was not statistically significant. On the average, the older subjects made 37 percent more readings and used 85 percent more time. It was inferred that they had more difficulty in assigning meanings to their readings and more trouble with the short-term memory requirements of the task than did the young subjects.

Using a slightly modified version of John's (1957) device, Jerome (1960) tested two contrasting age groups, choosing a procedure appropriate for the work rate of the aged subjects. The test involved an electrically monitored, button-pressing, event-ordering set of problems that required, for their solution, the integration of sequentially elicited, discrete items of information transmitted on demand as signals from the apparatus. Problems were at four levels of difficulty, with two equivalent forms at each level. Each subject attempted the problems in ascending order of difficulty. If he failed to solve a problem, he was given the alternate form at the same level of difficulty. If he failed to solve this, he was terminated; if he succeeded, he was promoted to the next rank. This procedure was continued with each subject until he failed twice in one rank or passed at all four levels of difficulty. The achievements of the aged and of the young subjects differed sharply, with the least proficient of the young subjects slightly superior to the best of the aged. In all relevant indexes except the rate of inquiry, the young were superior by a factor greater than 2, and in some instances by a factor greater than 5. Perhaps more important than the differentiating power of this design, however, was its capacity to supply data as a basis for diagnosing the heuristic deficiencies that obstructed or precluded success. Causes indicated for the manifest ineptitude of the older subjects were as follows: (a) an inability or unwillingness to apply a strategy that was repeatedly demonstrated and that every young subject employed skillfully, (b) an apparent lack of appreciation of the value of identifying the specific goal condition of a problem early in the effort, (c) a disorderly search behavior, (d) a high degree of redundancy of inquiry, and (e) a disinclination to keep notes. It was inferred from these results that the patterns of heuristic control, so laboriously acquired during youth through formal education and emulation of skillful and successful associates, decay significantly with disuse and with age.

In summary, data from a large number of cross-sectional investigations encouraged the belief that the problem-solving abilities of mature persons differ widely with age, particularly in the United States. Although the few current longitudinal observations did not completely discredit the presumption that the difference in favor of youth resulted from an individual deterioration with age, they also failed to obtain the probative support logically required for the hypothesis of cognitive degeneration. On the other hand, the processes that were found defective in older subjects—applying simple solution strategies, identifying specific goals,

orderly inquiry, preservation of information—depended only on fundamental heuristic principles that had been taught to all generations in our culture. When, therefore, an allegedly normal group was found defective in their use, it was attractive to assume that these behavioral learnings had decayed, probably through disuse, rather than to presume that they had never been acquired.

Finally, a possibility that received conventional obeisance from all workers in the area was that suprasextogenarians did not invest in these artificial and—let it be acknowledged—mildly ludicrous tests as much ego involvement and effort as younger subjects did. Inferences derived from studies like those described above must be qualified in the light of the uncertain contributions of motivation.

Motivation

Botwinick (1959) and Kuhlen (1959) discussed motivation of different age groups, a fundamental problem that related to the broad range of psychological aspects of aging and that raised questions of stimulus equivalence and response equivalence. In most experiments the equivalence of subjects' motivation was taken for granted; yet if this differed with age, failure to control the variable, or at least to measure it, could result in a false interpretation of results. The crucial point for research on aging was whether motivational response varied as a function of age when people were placed in the same objective (but not necessarily the same subjective) situation. Recent research provided tentative answers to three pertinent questions: (a) Do people of different ages vary in social interests and needs and emotional reactions? (b) Do people of different ages vary in the amount of confidence and caution they display? (c) As age increases, is there any alteration in expectations, set, or attitude toward change?

Social Interests and Needs and Emotional Reactions

Social withdrawal with increasing age was found by Bendig (1960), who investigated changes in scores on the *Guilford-Zimmerman Temperament Survey* among four groups of 100 subjects each, in their twenties, thirties, forties, and fifties. Ascendance and sociability (which are highly correlated) and masculinity declined with age, but restraint increased with age. A change somewhat later in life was found by Schaie (1959) in a study of 500 subjects aged 20 to 70. He included a short social responsibility scale as padding among the items of a personality inventory. The social responsibility scores increased with age to the mid-fifties and then decreased. Dean (1960) asked 280 subjects aged 49 to 89 to name the "best things" and "worst things" about their present lives. "Best things," classified as "activity in the outside world," "intake from the world," and "survival," showed the expected trend toward withdrawal

with age. "Worst things" in the younger groups were "threats to survival" and, among older subjects, "frustrated outside activities."

That emotional excitement also seemed to decrease with age was shown by Rosen and Neugarten (1960), who gave the *Thematic Apperception Test (TAT)* to 144 subjects aged 40 to 71. Older subjects introduced fewer extra characters into their test stories, used less conflict and less strong emotions, and described less vigorous activities. These results were shown to be due to age rather than to sex or social class, although it was possible that the content of the *TAT* pictures, particularly the apparent age of the figures portrayed, influenced the results. Similar findings, however, were obtained by Lakin and Eisdorfer (1960) in response to a Reitman stick-figure test. Twenty-four subjects of a mean age of 23.7 mentioned more emotions, a greater intensity of emotion, and more activity than 55 subjects with a mean age of 73.2. Contrary to expectation, the old named as few somatic responses as the young, although a comparison group of young patients did give more somatic responses. Lakin and Eisdorfer suggested that preoccupation with survival might have been the result of psychosocial and physical assaults rather than a concomitant of age itself. In related work, Veroff and others (1960) used *TAT* pictures to study three needs—affiliation, achievement, and power—in a nationwide sample of 590 men and 770 women aged 21 to over 65. As might have been expected, results showed decreases with increasing age in need for achievement among men and in need for affiliation and need for power among women, but need for power increased with age among men. An interesting comparison of married subjects over 50 with widows and widowers of similar age showed that the bereaved had lower need for achievement, lower need for affiliation, and, among women only, lower need for power. Although length of time since bereavement was not taken into account, this personal factor may have helped determine the needs expressed.

Is the apparent withdrawal with age "natural" or the result of stress? Cumming and others (1960), in their theory of disengagement, stated that, as a person ages, there is a reduction in the amount, variety, and intensity of social interaction, that the individual becomes more concerned with integrating his own thought and views on the world. They held that this reduction in outward activity is normal, with death as the logical end, and that older persons holding middle-aged standards would be ill-adjusted and probably of low morale. It seemed likely, however, from the work described above, that stress plays a part in disengagement.

Confidence and Caution

Caution among older people was examined by Wallach and Kogan (1961). Their subjects were 89 women and 65 men of a mean age of 70.3 and 132 women and 225 men college undergraduates. Vocabulary scores were higher for the old than for the young. In completing a ques-

tionnaire about the chances of occurrence of certain future events, older subjects made less extreme estimates than younger ones. Scores indicated that the subjects' confidence about their judgments decreased with age for both sexes, more markedly among men, while men among young subjects had higher confidence than women. The probability of success required before the subject would advocate a high-risk, high-reward course of action was found to increase with age. From these results Wallach and Kogan suggested that caution becomes more pronounced with age.

In another attempt to account for age differences in performance, Botwinick, Brinley, and Robbin (1958a, 1959a, b) studied auditory reaction time. They gave 30 subjects, median age 23, and 30 subjects, median age 71, a series of auditory stimuli with quasi-random preparatory intervals (PI's). Whenever reaction time was more than the subject's own median he was given an electric shock. Older subjects were slower to react than younger subjects, but shock reduced reaction times equally for both groups. When a regular series of PI's was used, the older subjects improved with shock more than the younger. The difference was confirmed with two additional groups of subjects. Botwinick, Brinley, and Robbin (1958b) studied the effects of exposure time on judgment of line length. Tasks at six levels of difficulty were administered to 34 subjects, median age 71, and to 26 subjects, median age 22.5. When exposure was reduced from 2.0 seconds to 0.15 seconds, latency of response was reduced, but so also was accuracy. The largest reduction in latency occurred for the older subjects on difficult discriminations, but even then their performance did not equal that of the younger group. Griew (1958, 1959) studied reaction time using lights: the number of lights from which the stimulus might come varied from one to eight, but in each case the same response had to be made. The performance of young subjects dropped only when sources were increased to eight, whereas that of aged subjects dropped when sources were increased only from one to two. In a further experiment, when the stimuli flashed on for less than 150 milliseconds, the disproportionate increase in reaction time of the older subjects did not occur. Both experiments were done with small numbers of subjects.

Many of the experiments described here used subjects from only two age groups, "young" and "old." At least three age groups are needed to draw reliable conclusions about age trends. The evidence did suggest, however, that older subjects were more cautious in their responses than younger ones and that in tasks where expectancy was constant their performance could be improved by increased motivation, for instance in the form of electric shocks. When stimuli were unexpected, older subjects were less able to deal with them, and performance could not be improved so easily.

Expectations, Set, and Attitude to Change

Talland (1959) studied the effect of expectation on reproduction of words heard at the threshold of intelligibility, with three groups of sub-

jects aged 20 to 40, 65 to 75, and 77 to 89. Subjects of all ages benefited equally by the introduction of a set, whether explicit or implicit. However, rapid shifting of sets or use of countersets caused a marked fall in performance with age. Talland noted that older subjects often remained silent if unsure of words. On inquiry, they sometimes said they had heard certain words, but disregarded them because they were not in the class expected.

Several studies showed that older people seemed less willing than younger ones to adapt their behavior with changes in stimuli. In Schaie's (1958) study, 500 subjects aged 20 to 70 showed a marked and approximately linear increase in personality rigidity with increase in age. Riegel and Riegel (1960) found that the type of item included in rigidity questionnaires appeared to influence responses. A marked increase in rigidity and dogmatism among 380 subjects over 55 compared with 120 subjects aged 17 to 19 was largely accounted for by the older subjects' more frequent agreement with clichés. Intelligence was not measured in this investigation. Chown (1960) found similar results in responses to a rigidity questionnaire by 200 subjects aged 20 to 81. She factor-analyzed a matrix consisting of the scale items, age, and measures of verbal ability and nonverbal ability. Three factors were found: normal obsessionality, cliché agreement (related to low nonverbal intelligence), and liking for habit (which was most closely related to increasing age).

Older people also compared unfavorably with younger ones on tests which measured ability to change intellectual or motor performance, according to studies by Chown (1961), Mangan (1958), Mangan and Clark (1958), and Schaie (1958). This lack of flexibility was closely associated with fall-off in intellectual skill and motor speed.

In general, research tended to support the idea that there is diminished activity and social participation and greater cautiousness and rigidity of outlook with advancing age. Many of these variations in performance might, if found in young subjects, have been ascribed to differences in motivation. When several age groups were involved, however, the primacy of any one factor—decline in ability, decline in expectations, or decline in motivation—was not determined. Changes in drive and temperament probably interact with perceptual and intellectual characteristics, and it is quite possible that in complex behavior the change in any one condition may mimic that in another. For this reason, studies during the past decade, characterized by statistical analyses of interactions, could be followed to advantage by experimental studies designed to give a clearer picture of the psychological changes in older persons and their primary antecedents.

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CHAPTER V

Meaningful Learning and Retention: Intrapersonal Cognitive Variables

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MOST OF the discussion in this chapter will be confined to research in cognitive structure variables and in cognitive style. The influence of individual differences in intellectual ability on learning, problem solving, academic achievement, and creativity has been adequately covered in two previous REVIEW issues, "The Education of Exceptional Children" (December 1959) and "Educational and Psychological Testing" (February 1959). The learner's developmental readiness for different kinds, components, levels of difficulty, and methods of teaching of subject matter, as influenced by age-level differences in cognitive maturity, is obviously relevant in the context of intrapersonal cognitive variables and has been considered in Chapter I of this issue.

Cognitive Structure Variables

By cognitive structure is meant an individual's organization, stability, and clarity of knowledge in a particular subject-matter field relative to meaningful new learning tasks in this field (Ausubel, 1961). In the more general and long-term sense, cognitive structure variables refer to the influence of significant organizational properties of the learner's *total* knowledge in this subject-matter field on his future academic performance in the same area. In the more specific and short-term sense, cognitive structure variables refer to the effects of the organizational properties of just the *immediately* (or proximately) relevant concepts within a particular subject-matter field on the learning and retention of *small units* of related subject matter.

The importance of cognitive structure variables has been generally underestimated in the past because preoccupation with noncognitive, rote, and motor types of learning has tended to focus attention on such current situational and intrapersonal factors as task, practice, drive, incentive, and reinforcement variables. It is true that the influence of prior experience on current learning tasks is conventionally considered under the heading of positive and negative transfer (or proactive facilitation and inhibition), but such transfer is generally interpreted in terms of the *direct* interaction between the stimulus and response attributes of the two overlapping but essentially discrete learning tasks (i.e., the recently experienced and the current).

* The writers acknowledge with appreciation the bibliographical assistance of Pearl Ausubel.

Theoretical Formulations of Cognitive Structure

Much more saliently than in experimental laboratory types of learning situations, typical school learning requires the incorporation of new concepts and information into an established cognitive framework with particular organizational properties. The transfer paradigm still applies here, and transfer still refers to the impact of prior experience upon current learning. But prior experience in this case is conceptualized as a cumulatively acquired, hierarchically organized, and established body of knowledge which is organically relatable to the new learning task, rather than as a recently experienced constellation of stimulus-response connections influencing the learning of another discrete set of such connections. Furthermore, the relevant aspects of past experience in this type of transfer paradigm are such organizational properties of the learner's subject-matter knowledge as clarity, stability, generalizability, inclusiveness, cohesiveness, and discriminability (i.e., cognitive structure variables)—*not* the degree of similarity between stimuli and responses in the two learning tasks. Further, recent prior experience is not regarded as influencing current learning by interacting *directly* with the stimulus-response components of the new learning task, except insofar as it modifies significant relevant attributes of cognitive structure. In an empirical test of this theoretical orientation, Ausubel and Blake (1958), using a proactive inhibition research design, demonstrated that meaningful learning and retention of a passage on Buddhism was not adversely affected by recent prior learning of interfering materials, for example, on Christianity.

Bruner's (1960) concept of "structure," in which he elaborated in a school learning context his previously published views on "going beyond the information given," was related to the concepts of cognitive structure and transfer as defined above. Mastery of the fundamental ideas of a discipline (its structure), he claimed, both makes the subject matter more comprehensible and easier to retain and facilitates transfer. Although these propositions, in their general form, had considerable face validity, Bruner's particular formulation was vulnerable on two counts. In the first place, he asserted that most specific memories can be forgotten with impunity as long as they are derivable or can be "reconstructed" when needed from those "generic" concepts or formulas which *are* worth remembering. Actually, however, relatively little school knowledge conforms to this derivative or "regenerative" model of memory in which the loss of specifics constitutes no great disadvantage in terms of academic achievement. New learning materials more frequently bear a *correlative* than a derivative relationship to established concepts in cognitive structure, and the forgetting of meaningful learned material, according to Ausubel (1960a), is largely a disadvantageous process of "obliterative subsumption" in which the identity of newly incorporated specific items is no longer dissociable from the more inclusive and generalized meaning

represented by the established concept under which they are subsumed. Second, in accordance with traditional usage, Bruner restricted the use of the term "transfer" to those instances in which "a general idea . . . can be used as a basis for recognizing subsequent problems as special cases of the idea originally mastered." However, Ausubel (1961) observed that in the vast majority of classroom learning situations where cognitive structure variables play a significant role, the transfer paradigm was more frequently applicable to the incorporation and retention of presented verbal material (i.e., "reception learning") than to "discovery learning" or problem solving.

Long-Term Studies: Improvement of Thinking

Despite their self-evident significance for school learning, long-term studies of cognitive-structure variables involving subject-matter achievement were extremely sparse. Very little research in this area conformed to the minimal necessary research design (i.e., the transfer paradigm), which requires that a single attribute of cognitive structure first be deliberately manipulated, using adequate experimental and/or statistical control procedures, and that this altered cognitive structure then be related to long-term achievement outcomes in an extended program of new studies in the same field.

Promising attempts to enhance critical thinking ability by influencing cognitive structure in particular subject-matter areas were made by Abercrombie (1960), Suchman (1959, 1960), and Smith (1960). Abercrombie tried to improve medical students' ability to reason effectively by providing them with opportunities for "therapeutic" group discussion in an unstructured, nonauthoritarian atmosphere. Ability to analyze X rays was used as the criterion for assessing the effects of this training. Abercrombie's findings were generally in the predicted direction but were vulnerable on the grounds of failure to control for the Hawthorne effect.

Suchman (1960) experimented with the teaching of strategies and tactics of scientific inquiry to children to help them to learn to apply them in question-and-answer investigations. Preliminary findings by Suchman (1959) indicated that although such training increased the number of valid questions children asked in the test (criterion) situation, it did not significantly enhance the quality of the questions or facilitate grasp of concepts. Hence, more definitive evidence of the transfer value of such training to new situations was being sought, and the new criteria of transfer being employed were not only more independent of the particular training procedures used but also more reflective of the ultimate purpose of such training, i.e., greater knowledge of the content and/or the method of science.

Smith (1960), with Henderson's assistance, developed instructional materials designed to develop critical thinking abilities, and then helped teachers to learn how to handle these materials in the classroom. They

found wide differences among students of different teachers with respect to improvement in critical thinking, but refrained from drawing definitive conclusions because they had not yet devised a technique for describing and measuring what teachers were *actually* doing in this situation. Their next step, therefore, was to devise a method of categorizing the logical operations in thinking. The great value of this approach is twofold: First, it involves an attempt to influence critical thinking through the simultaneous teaching of both the logic of a particular subject-matter field and its content, rather than through general principles of logic; second, this category system promises to do much to place long-term classroom studies of cognitive structure variables on a sound experimental basis because of its attempt to quantify the crucially important but elusive teaching variable. Aschner's (1961) useful category system for classifying the thought processes reflected in verbal behavior was based on Guilford's conception of the structure of intellect.

Long-Term Studies: Influence of Existing Knowledge on Achievement

Studies in which the degree of existing knowledge of subject matter at one level of educational attainment was related to performance at subsequent educational levels also conformed to the long-term transfer paradigm. Constancy of academic attainment was, of course, attributable in part to constancy of academic aptitude and motivation. But, especially when these latter factors were controlled, it was reasonable to attribute some of the obtained relationship between earlier and later educational levels to the cumulative effects of cognitive structure variables.

Automated teaching and other forms of programed instruction appeared to exert a leveling influence on the relationship between the degree of existing knowledge and that of new learning in the same subject-matter area. Meyer (1960) obtained a correlation of —.52 between pretest scores on knowledge of English prefixes and gain in such knowledge after 10 days of self-instruction with a programed workbook. Little (1960) similarly found that drill machines giving immediate knowledge of results of practice tests in an educational psychology course, as well as opportunity to correct mistakes by drill, benefited those students most who usually scored in the lower half of the distribution. As a result of such teaching both the more and the less knowledgeable subjects moved upward in attainment, but the terminal achievement of the two groups tended to converge.

Long-Term Studies: Improvement of Instruction

Many of the curriculum-reform movements attempted to enhance long-term learning and retention by influencing cognitive structure variables. The University of Illinois Committee on School Mathematics (Beberman,

1958), for example, stressed initial self-discovery of generalizations by students, followed by precise, consistent, and unambiguous verbalization of modern concepts. The Secondary School Physics Program of the Physical Science Study Committee (Finlay, 1960) placed great emphasis on the integrative and widely generalizable concepts in modern physics; on inquiry in depth rather than on broad, superficial coverage of the field; on careful, sequential programing of principles; and on conveying to the student something of the spirit and methods of physics as a developing experimental science. Implicit in each program was the assumption that whatever ultimate superiority in academic attainment was achieved by following these pedagogic principles would be attributable to cumulative changes in the organization, stability, and clarity of cognitive structure.

Achievement-test data provided by evaluative studies of such programs offered presumptive evidence regarding the long-term effects of cognitive structure variables. Nevertheless, this type of research did not conform to the transfer paradigm, since the learning of *new* material in the same subject-matter field was not studied as a function of modified cognitive structure. Furthermore, not only was it impossible in such programs to isolate the effects of the individual variables involved, but also only rarely was any effort made to obtain comparable achievement data from control groups or to control for the Hawthorne effect. Measurement also was a difficult problem, because standardized achievement tests both covered various traditional subject-matter units deliberately ignored by these new curriculums and failed to measure knowledge of the more modern concepts which they emphasized. All of these difficulties pointed up the unfeasibility of using curriculum research as a source of rigorous experimental evidence bearing on a single cognitive structure variable.

Similar kinds of presumptive evidence regarding the long-term effects of cognitive structure variables came from studies of automated teaching. Pressey (1960) systematically used a self-instructional (punchboard) device as an integral part of a course in educational psychology. This device both provided immediate feedback and guided the student to the correct answer if he was wrong. Students using the punchboard made higher midterm and final examination scores than did control subjects. Little (1960) and Stephens (1960) reported similar findings. Nevertheless, although control groups were employed in these studies, the transfer paradigm was not followed, the effects of the drill and feedback variables were not isolated from each other, the Hawthorne effect was disregarded, and no attempt was made to equate experimental and control groups with respect to actual degree of exposure to relevant learning material.

Long-term experimental evidence derived from more modern teaching machine procedures is equally sparse. The study conducted by Skinner and Holland (1960) on programed instruction in introductory psychology, for example, was subject to all the methodological criticisms listed above in addition to the fact that control groups were not used. Porter's

(1959) study of programed instruction in spelling and Meyer's (1960) aforementioned vocabulary study were notable for the use of matched control groups, and the latter study also attempted to isolate the effects of single variables.

Despite the paucity of rigorous experimental work in this area, it was evident that, with proper controls, with manipulation of single variables, and with use of the transfer paradigm, automatic teaching devices could provide much valuable evidence on the long-term effects of cognitive structure variables. Programed learning procedures enhanced the stability and clarity of cognitive structure in two important ways: First, by supplying immediate feedback, they corrected wrong choice of alternative meanings, misinterpretations, ambiguities, and misconceptions before they had an opportunity to impair the clarity of cognitive structure and thereby to inhibit the learning of *new* material; second, by deferring the introduction of new material until prior material in the learning sequence was thoroughly consolidated, they maximized the effects of both stability and clarity of cognitive structure on *new* learning.

Short-Term Studies

Ausubel (1960a) proposed the use of organizers (i.e., advance introductory material at a high level of abstraction, generality, and inclusiveness) as a means of investigating programmatically the effects of short-term cognitive structure variables. By systematically manipulating the properties of organizers, it was possible to influence various attributes of cognitive structure (e.g., the availability to the learner of relevant and proximately inclusive subsumers, and the clarity, stability, discriminability, cohesiveness, and integrativeness of these subsumers) and then to ascertain the influence of this manipulation on new learning, retention, and problem solving. Such studies employed control subjects who were exposed to similar introductory materials, except for the particular variable under investigation, and hence followed the transfer paradigm. Ausubel (1960b) showed, for example, that when undergraduates were exposed to organizers presenting relevant and appropriately inclusive subsuming concepts, they were better able to learn and retain unfamiliar ideational material. Where the new learning material was relatable to previously learned concepts, as in the more typical classroom situation, the learner's ability to discriminate between the two bodies of material was obviously an important variable. Ausubel and Fitzgerald (1961) demonstrated that such discriminability was partly a function of the stability and clarity of these previously learned concepts (as measured by an achievement test) and that when discriminability was low because of inadequate prior knowledge, learning and retention could be enhanced by the use of "comparative organizers."

Several investigators used automated teaching devices in short-term studies of learning and retention, but they generally restricted their atten-

tion to the relative effectiveness of these devices compared to conventional classroom instruction. Coulson and Silberman (1960) and Evans, Glaser, and Homme (1960), for example, reported that university students, using simulated teaching machines and programed textbooks, respectively, were better able to learn small units of meaningful material than were control groups employing comparable conventional methods. These studies also isolated the effects of such variables as size of step and mode and overtness of response. But unless the transfer paradigm is followed (i.e., until the effect of prior exposure to such factors was related to the learning of *new* material), the rich potentialities of these devices for increasing our knowledge of cognitive structure variables cannot be realized.

Information about the effects of cognitive structure on learning could be gleaned from many traditional studies of transfer of training. Morrisett and Hovland (1959) showed that transfer in learning set problems was a function both of mastery within a given type of problem and of experience with a variety of problems (i.e., generalization between problems). Goss and Moylan (1958) and Yarczower (1959) also demonstrated that the facilitating effect of verbal pretraining on concept formation was relative to the subjects' mastery of discriminative verbal cues during pretraining. Heterogeneous presentation of stimulus material that did not provide sufficient repetition to allow for mastery not only was less effective than homogeneous presentation in learning a principle but also, according to Sassenrath's (1959) data, did not facilitate during a transfer period the learning of a principle which was the reverse of the original. An incidental finding in this study confirmed the transfer value of furnishing to subjects feedback about the correctness of responses in the training series.

Evidence continued to accumulate regarding the mediating function of implicit verbal processes in concept formation. Liublinskaya (1957) and Kendler and Karasik (1958) showed that the availability of distinctive verbal responses facilitated concept formation and conceptual transfer; also confirming earlier findings in this area, Weir and Stevenson (1959) reported that *explicit* instructions to verbalize enhanced transposition learning in children and that this effect was unrelated to chronological age within the age range of three to nine. Mere ability to verbalize, however, may have constituted no advantage in certain simple transposition problems, inasmuch as "preverbal" preschool children seemed to do as well as "verbal" children (Rudel, 1958; Gonzalez and Ross, 1958). Both Sassenrath (1959) and Bensberg (1958) demonstrated that, even when the transfer task required the learning of a reversal principle, preliminary training on the original form of the principle, when accompanied by mediating symbolic processes, had facilitating rather than inhibitory effects. In support of Judd's classical research on transfer, Ervin (1960) found that verbal instruction in relevant physical principles underlying a given motor performance increased transfer to analogous motor performance in third-grade and fourth-grade children. This effect, however,

did not occur unless the subjects were able to perceive both the similarity between the two motor tasks and the link between verbal principles and performance.

The issue of directed *versus* independent discovery in learning and transferring principles was still very much in doubt, partly because of the difficulty of holding constant such other relevant factors as the rote-meaningful, inductive-deductive, verbalization, and motivational variables. Haslerud and Meyers (1958) concluded from a coding experiment that encoding practice was more transferable when coding principles were independently derived than when they were given. This conclusion was questionable, however, in view of the fact that their subjects exhibited significantly better initial learning on those problems for which the rule was given. Further, the less debatable of the two types of analysis performed showed no significant difference in score on a delayed test of code identification between problems originally learned by these two methods. Kersh (1958) did find significant differences in favor of a "no help" as against a "directed reference" and "rule given" group on a delayed test of ability to infer rules from arithmetic problems, but he also presented evidence suggesting that this superiority was attributable to the greater interest and drive instigated by the independent discovery procedure in the interval between the initial and later test, rather than to superior understanding or meaningfulness.

Cognitive Style

Research interest continued to be active in the area of "cognitive style," i.e., self-consistent and enduring individual differences in cognitive organization and functioning. Cognitive style refers both to individual differences in general principles of cognitive organization (e.g., simplification and consistency trends) and to self-consistent idiosyncratic tendencies that are not reflective of human cognitive functioning in general (e.g., intolerance for ambiguity; memory for particular kinds of experience). It reflects differences in personality organization as well as genetically and experientially determined differences in cognitive capacity and functioning. A serious methodological weakness common to many of the studies in this area was their utilization of measures of cognitive style, its determinants, and its functional consequences for which adequate intratask or intertask generality of function had not been established.

Holzman and Gardner (1960) used the Schematizing Test, with an odd-even reliability coefficient of .84 to .90, to measure leveling-sharpening tendencies. They found that "sharpeners" surpassed "levelers" in ability to recall anecdotal material. Berkowitz (1957) showed that leveling tendencies manifested significant generality of function and that "levelers" tended to prefer simple to complex phenomenal experience. Gardner and others (1959), employing a factor-analytic approach, isolated a limited number of control principles reflective of individual consistencies

in cognitive behavior. These factors differed for men and women subjects. "Retention style" was studied by Paul (1959), who found general and consistent individual differences with respect to importation, amount of material retained, and the use and retention of imagery.

Rokeach (1960) obtained evidence of a generalized "open-closed" dimension of belief systems measured by a Dogmatism Scale and an Opinionation Scale with respective reliability coefficients of approximately .80 and .70. In validating these scales he noted that Catholics made high dogmatism and right-opinionation scores, whereas Communists and religious disbelievers made high dogmatism and left-opinionation scores. Only the right-opinionation groups, however, tended to score high on the Berkeley Fascism and Ethnocentrism Scales.

Luchins and Luchins (1959), in reviewing the literature on rigidity of behavior and the effect of *Einstellung*, asserted that no conclusions were possible at that time as to whether a general and self-consistent factor of rigidity existed. The intratask generality of individual differences in the water-jar *Einstellung* test had not yet been determined, and the validity of this measure, as well as its relationship both to other measures of rigidity and to other personality traits, were highly equivocal. Rokeach (1960), on the other hand, presented evidence which suggests that "closed" and rigid individuals experience difficulty in synthetic and analytic thinking, respectively. In an investigation of intra-individual consistency in "the use of affect labels in describing and categorizing social and ink blot stimuli," Kagan, Moss, and Sigel (1960) were able to demonstrate significantly positive intercorrelations among their four measures.

Broverman (1960a, b) identified "conceptual *versus* perceptual-motor dominance" and "strong *versus* weak automatization" styles on a word-color interference test. He then demonstrated that "conceptually dominant" subjects were less distracted than "perceptual-motor dominant" subjects on a difficult conceptual task and that "strong automatizers" were less distracted than "weak automatizers" both on an automatized conceptual and on an automatized perceptual-motor task (Broverman, 1960b). Parallel kinds of results also were reported for the effects of these same cognitive style variables on intra-individual differences in response strength (Broverman, 1960a). The significance of these findings, however, was diminished by the failure to consider intratask or intertask generality of function either for the measures of cognitive style or for the measures of their effects.

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CHAPTER VI

Meaningful Learning: Motivational, Personality, Interpersonal, and Social Variables

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THIS CHAPTER deals with studies of the motivational, personality, and social-cultural variables affecting meaningful learning. The section on extrinsic *versus* intrinsic motivation surveys the motivating effects of instructions on ego involvement, level of aspiration, and achievement motive. The personality variables given greatest attention are anxiety, self-attitudes, authoritarianism, and values and interests. The section on research on social-cultural variables includes teacher-pupil and peer relationships as well as group *versus* individual learning settings and the learning-variable concomitants of socioeconomic status.

Extrinsic Versus Intrinsic Motivation

The first section of this chapter deals with studies of motivation contributing to the practical understanding of learning and achievement. The specific variables include those under control by the teacher or other outside source, those intrinsic in the learner as general personality characteristics, and those modifying motivation as a result of particular learning settings. Motivation is assumed to have both energizing and directive effects on performance, although the latter function is technically controversial since similar effects often may be attributed to learning or set processes.

Several volumes on motivation that are of general interest were published. Three issues of the annual *Nebraska Symposium on Motivation* (Jones, 1958, 1959, 1960) covered a wide range of theoretical positions and methodological problems in the investigation of motivation. J. S. Brown (1961) published an excellent integrative work dealing with the analysis of the concept of motivation and related empirical studies.

Motivating Effects of Instructions

Psychologists and educators are well aware that the behavior of their subjects and students can be manipulated by instructions. Sets, so induced, enhance performance through strengthening the associative processes by providing response-directed cues or through increasing the general drive level of the recipient by nonspecific directions to "work harder" or to "work faster."

There is little doubt about the influence of external stimulus control on the performance of the pupil. In four experiments based on principles from Skinner's laboratory, Keislar (1960) showed that neutral stimuli could be conditioned to have cue properties usable in new situations for producing new problem-solving activity, for indicating to the subjects when to learn, and for designating what they should learn. Rather than rely on the concept of interest, he offered a convincing explanation that variations among pupils in what they learn from a common experience depend on learning sets developed through prior histories of differential programs of reinforcement.

In another context, Bruner (1961) argued against heavy reliance by pupils on external rewards, such as parental or teacher approval, in the process of discovery, because these tend to develop conforming and rote behavior and to inhibit autonomous motivations. Discovery was presumed to demand self-reward resulting from information concerning the appropriateness of responses intrinsic to the task. To the extent that such motives of mastery or competence are developed, the role of external rewards as reinforcements in the shaping of behavior was said to be lessened.

Despite the theoretical controversies, the empirical evidence that motivation may be externally controlled was both consistent and convincing. Owen (1959) reported that children between seven and one-half and nine years of age who were told to "work faster" after a first task had lower reaction times than those who were given task-oriented instructions or instructions to "relax." Marvel (1959) found that verbal set for speed alone yielded greater gains in reading rate and retention than did the use of the tachistoscope, with and without the instruction. Entwisle (1961) reported that merely calling attention to a given body of subject matter (administering attensity) fostered learning irrespective of the means by which attention was directed.

Ego Involvement, Level of Aspiration, and Achievement Motive

A change in motivation was found to occur as a result of the manipulation of ego involvement after success or failure. Davids and White (1958), for example, showed that disturbed children's goal-setting after failure was most affected by the nature of the task (whether or not the task was like one in school in which they had previously failed), by the threat of loss of self-esteem, and by the threat of loss of the experimenter's admiration. The changes in level of aspiration ranged from extraordinary reduction to increase toward highly unrealistic goals. Successful pupils, according to Worell (1959), tend to hold aspirations close to previous performance. In an excellently conducted study, Rosenfeld and Zander (1961) demonstrated that disapproval of inadequate performance had no effect on aspiration level. Disapproval, when performance was as good as the student felt capable of, had negative effects on aspiration setting.

Indiscriminate reward lessened acceptance of a teacher's influence, while reward for adequate performance increased acceptance of the teacher's influence. Grades aspired to were more in line with actual grades when the teacher used reward power discriminately than when coercive power was used.

Relationship between the level of aspiration and the generalized motive to achieve was shown in several studies. The relationship between the achievement motive and performance was exemplified by French and Thomas' (1958) finding that subjects with high need to achieve were more likely to reach a solution in a problem-solving task than were subjects with low need to achieve. Although one study (Uhlinger and Stephens, 1960) provided only partial support for the hypothesis that high achievers have a greater need to achieve than low achievers, another study (Krug, 1959) demonstrated that when overachievement and underachievement are taken as a departure from a regression line based on aptitude and achievement measures, the achievement motive scale of the *Edwards Personal Preference Schedule* is the one scale that discriminates between the two groups. Weiss, Wertheimer, and Groesbeck (1959) reported that two measures of achievement motivation (McClelland's *Picture Story Test* and the need-to-achieve scale of the *Edwards Personal Preference Schedule*) in combination with an academic aptitude test proved to be powerful predictors of college performance. In attempting more precise formulations, McBee and Duke (1960) concluded that achievement was an additive, rather than a multiplicative, function of intelligence and motivation.

Personality Variables

This section is restricted to the personality factors that received most attention during the past three years. Of general interest was a carefully conducted and extensive study by d'Heurle, Mellinger, and Haggard (1959) in which they compared the personality patterns of high achievers in spelling, reading, and arithmetic. High general achievers were characterized by traits representing responsiveness to cultural influences; high arithmetic achievers by ego integration and maturity; high reading achievers by negative reactions to authority, by insecurity in relationships with adults, and by independence; and high achievers in spelling by passivity, by dependence on authority, by relative lack of imagination, and by inflexibility.

Anxiety

In terms of the number of published articles on motivation, the most popular motivational concept was anxiety. But despite the large proportion of publications in this area, definite conclusions still remained to be determined according to Reed's (1960) review of studies representing several theoretical orientations. He concluded that both severe and very low levels

of anxiety tend to depress learning; that mild anxiety may function in a positive manner for some kinds of learning; that variations in the reported effects of anxiety result from methodological differences; and that the multiple effects of anxiety cannot be accounted for by any single theory.

A systematic series of formal studies investigating anxiety in elementary-school children, by S. B. Sarason and others (1960), deserves careful reading by all involved in the study of learning.

An extensive factor analysis of anxiety was made by Cattell and Scheier (1958). One form of anxiety, labeled U. I. 24 (conscious anxiety), was tentatively related to verbal ability, arithmetic ability, and a wide variety of learning and achievement measures, for children but not for adults. This type of anxiety was characterized by ergic tension, guilt proneness, and emotionality. Phillips, Hindsman, and McGuire (1960), studying the U. I. 24 anxiety factor further, provided additional confirmation of its relationship to marks among adolescents. Nevertheless, the relationship of anxiety to achievement was far from clear-cut. Sex differences interacting with grade level (Morgan, Sutton-Smith, and Rosenberg, 1960), with educational level (Reese, 1961; Broen, 1959), with anxiety level (Grooms and Endler, 1960), and with achievement level within grade levels (Spielberger and Katzenmeyer, 1959) were among the factors shown to determine the prediction of achievement from anxiety.

Though it is assumed in correlational studies that anxiety is a chronic state of the individual, motivation from anxiety can be modified by manipulating situational elements. According to I. G. Sarason (1958), reassurance instructions facilitated the performance of high-anxious subjects and impaired the performance of low-anxious subjects on a complex learning task. The converse was found for standard or task-oriented instructions. Taylor's (1958) data indicated that high-anxious subjects were superior to low-anxious subjects under neutral conditions, but that reporting inadequate performance (stress) impaired the performance of all subjects. The foregoing studies and those by Wiener (1959) and Waite and others (1958) tended to confirm the idea that stress and/or anxiety produce responses that interfere, or are incompatible, with the learning task. Bardach (1960), S. B. Sarason and others (1960), and other researchers proposed further that when chronic or induced anxiety produces responses that are compatible with the learning task, performance is facilitated.

Self-Attitudes

Poor self-attitudes imply a lack of confidence that adversely affects general adjustment to the environment and proficiency in school. Roth (1959) tested the hypothesis that if demands for reading improvement are viewed as a personal threat the individual defends against the threat and maintains his self-concept. If these demands are nonthreatening, the self-concept is changed commensurate with, and including, new experi-

ence. Defense against the threat includes distortion of the experience so as to integrate very little of it into the self-concept, or withdrawal from the situation. Partial confirmation of the hypothesis was attained, since the attrition and nonimprovement groups were more defensive on measures of self as self than improvement groups and improvers seemed to show greater concern with self as student and self as reader after training. Although the technical presentation of this study was poor and some of the statistical analyses were naïve (both *t*-tests and chi-square analyses were made on the same data, for example, without an immediately apparent reason), the study was interesting in that it suggested the fruitful employment of the congruity and dissonance principles in the study of variables important to learning.

A procedure frequently employed in this area was to compare the self-attitudes of underachievers and overachievers. Frankel (1960) found that underachieving boys indicated more problems, particularly school problems, on the *Mooney Problem Check List* than did overachievers. The relationship of self-attitude to underachievement and overachievement also differed according to curriculums (Middleton and Guthrie, 1959) and college atmospheres (Holland, 1959, 1960). Aiken and Dreger (1961) found close relationships between attitudes toward mathematics and numerical ability among males but not among females.

Authoritarianism

The studies dealing with authoritarianism revealed that the associated characteristics of rigidity, hostility, and poor personal adjustment hinder learning of certain materials. Neel (1959), Hoffman (1960), and Frumkin (1961), for example, reported that the more authoritarian or dogmatic person had greater difficulty in the learning of unstructured tasks or tasks with a humanitarian philosophy than in the learning of factual materials. Kutner (1958) reported that a group of high-prejudiced seven-year-old children, compared with a low-prejudiced group, exhibited a high incidence of biased concepts, had difficulty in seeing relational attributes among stimuli, used concrete rather than abstract approaches, arrived at conclusions without testing hypotheses, and perseverated on unsuccessful hypotheses.

Values and Interests

Values and interests are assumed to be learned predispositions that, in a more general sense than other personality characteristics, have both energizing and directive functions in the control of behavior. Confirming this view, Winter (1961) reported that superior students and students in academic curriculums tended to hold traditional rather than emergent

values. Edwards and Wilson (1958) found that students having values indicating high prudence, that is, interest in the social significance of activities, had higher over-all academic grades. Those with primarily theoretic values, indicating interest in how things work, did not get higher grades even in science. The latter values seem to demonstrate a lack of differentiation between mechanical and heuristic problem-solving processes.

Social-Cultural Variables

The continuing interest in social influences was reflected in the studies of the effects on learning of teacher-pupil relationships, peer relationships, group *versus* individual problem solving, and social-class factors.

Teacher-Pupil Relationships

The literature in the area of teacher-pupil relationships dealt primarily with those characteristics of teacher style that appeared consistently in a number of situations. There were indications that the teacher's pattern of interaction with children may be related to emotional climate (Medley and Mitzel, 1959), to pupil perceptions of required and self-initiated work (Cogan, 1958a, b), and to the personality characteristics of the teacher (Ryans, 1959). Virtually none of the studies provided convincing evidence that teacher-pupil relationships affected the pupil's learning efficiency in any direct manner.

Flanders' (1960) exploratory study of the interaction between teacher style and pupil characteristics failed to confirm the hypothesis that dependence-prone pupils would achieve more with teachers using direct influence. Pupils of teachers using both direct and indirect influence in a flexible manner had higher academic achievement and scored significantly higher on classroom attitudes. Sustained patterns of direct influence tended to restrict learning and to produce less desirable attitudes. In testing a similar hypothesis, Beach (1960) found that socially oriented students achieved more in small groups and that less sociable students achieved more from lecture groups.

A few studies reported significant relationships between general climate indexes and academic achievement (G. I. Brown, 1960; Christensen, 1960; Davidson and Lang, 1960). It was apparent, nevertheless, that while some gains had been made in understanding the effects of teacher-pupil interaction on achievement, there was still a lack of positive and conclusive evidence. Gage (1958) implied skepticism that any relationship exists between one area of teacher-pupil interaction, that of the teacher's perceptions of pupils, and teacher effectiveness. His arguments were based on a summary of several carefully conducted and systematic investigations.

In a similar vein, Anderson (1959), after reviewing 49 studies dealing with authoritarian *versus* democratic leadership of teachers, indicated the lack of clear support for the superiority of one method over the other.

Peer Relationships

In the area of peer relationships the major concern was with peer acceptance. Ryan and Davie (1958) found a low positive relationship between social acceptance and grades. In a more analytical study by Williams (1958), achievement was more significantly related to acceptance extended *to* the group than to acceptance *by* the group. Hall and Gaeddert (1960) reported a moderately high relationship between friendship rating scales and grade averages of college students in fraternities and sororities. These results may necessitate qualification since, according to P. K. Brown (1960), social desirability discriminated the good from the poor performers among females in college population, but failed to separate the male students. In a detailed study of characteristics associated with sociometric choice status, Elkins (1958) reported a slight tendency for highly chosen children to be more intelligent and to achieve higher academic scores.

In general, there was considerable consistency in the findings of the studies reviewed. They indicated a significant positive relationship between social acceptance and achievement, whether the study was conducted with grade-school, secondary-school, or college populations. A more fundamental motivational factor has yet to be identified, since no cause-and-effect relationship could be inferred from these studies, all of which employed correlational designs.

Group Versus Individual Learning Settings

The greater efficiency of group over individual settings for learning may result from the provision for pooling the ideas that provide the basis for new associations, from an increase in motivation through mutual stimulation of members to increased activity, or from a reduction of anxiety. A comprehensive survey comparing group and individual performance on several variables was made by Lorge and others (1958), and a review of the relationship between personality and performance in small groups was published by Mann (1959).

Other more recent representative studies attested to the motivational influence of group settings. In a study conducted by Banghart (1959), the relationship between anxiety and problem-solving efficiency was significantly different between co-operative and un–co-operative groups when they were solving difficult problems but not when solving easy problems. Unfortunately, the author failed to present summary statistics describing the

level of each group's performance and thus precluded more analytical comparisons. Barnlund (1959) found that group decisions based on cooperative deliberations were superior to decisions made in individual settings or to decisions based on majority rule, particularly those following deadlocked decisions. The results were attributed to stimulation of greater task orientation and increased individual effort in the group settings. Related evidence presented by Faust (1959) indicated that the efficiency of *nominal* groups is less than that of *real* groups. The conclusions were indefinite, however, since more verbal than spatial problems were solved in one experiment than in the other. Hudgins (1960) reported the same general result for fifth-grade children, who were found to solve more arithmetic problems in groups than when working alone.

Socioeconomic Status

The specific values and attitudes associated with each socioeconomic level may be assumed to result in differences in general motivation and in ways of satisfying needs that will carry over to affect learning. Socioeconomic status was significantly related to several intelligence-test scores in a study by Knief and Stroud (1959) and to grade-point average in a study by Pierce-Jones (1959). In both cases the correlations were higher for teen-age boys than for girls. Gibboney (1959) found that, after studying a social-studies unit, sixth-grade pupils from upper-middle-class homes changed toward a greater acceptance of Mexicans, although the change was not significant, while the children from upper-lower-class homes changed significantly toward a rejection of Mexicans.

The effects of mobility tend to counteract the relationship between socioeconomic status and achievement. According to Udry (1960), status measures in a new community were not related to the achievement of pupils. Washburne (1959) concluded that the family's socioeconomic level has nothing to do with academic performance once the student gets into college.

Two other studies deserve particular attention. Mohandessi and Runkel (1958) conducted a unique study of the socioeconomic characteristics associated with high and low *Differential Aptitude Test* scores of pupils in more than 100 schools in Illinois. In a study by Terrell, Durkin, and Wiesley (1959), social class and kind of incentive were found to interact in affecting the degree of learning in a discrimination learning task. Middle-class children learned more rapidly with a nonmaterial reward (a flashing light) and lower-class children learned more efficiently when candy was used as an incentive. The differences were explained in terms of values associated with imaginative activity and material reward in the respective classes. While this conclusion seems plausible for the lower-class children, it appears less plausible for the middle-class children, since both incentives should have been effective.

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CHAPTER VII

Meaningful Learning and Retention: Task and Method Variables

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PRESENTATION of material to maximize pupil learning and retention is a major problem confronting the classroom teacher. Obviously, great variability is possible both in the instructional materials and in the methods of presentation. Materials may vary in such factors as difficulty, sequence, potential meaningfulness, redundancy, and internal organization. Presentation may vary according to such characteristics as type of classroom organization, teaching style, and procedure (lecture, discussion, or recitation). Variability stemming from materials is, in this chapter, termed *task variable*; variability stemming from the procedures used by the teacher is termed *method variable*. In the classroom learning situation, task variables require reaction by a pupil to a demand or suggestion of the teacher, other pupils, or the pupil himself. Method variables are basically those teacher behaviors that condition the learning situation in the classroom.

Studies related to teaching, instructional materials, and administrative procedures were reviewed in recent issues of the REVIEW by Bellack and Huebner (1960), Ellis (1960), and Herrick (1960). These reviewers, however, drew extensive attention to studies not specifically concerned with the criteria of pupil learning and retention.

Task and method variables and their effect on learning and retention are the primary concerns of this chapter. Although task and method variables may be considered separately, it is doubtful that they constitute a dichotomy. Certainly, some tasks require an emphasis on particular methods, and in this chapter joint task-method emphases denote such situations.

The effect of the teacher's knowledge on pupil learning and retention is an additional topic of concern in this chapter.

Task Variables

Although research dealing with task variables seemed insufficient in quantity, such studies as were completed during the last three years showed sophistication in their conception and procedure. The weakness of individual studies lay, perhaps, in the authors' failure to interpret findings or give specific suggestion for their implementation in a classroom

situation. Exceptions to this criticism, however, can be found in at least two studies, both dealing with tasks related to the initial phases of teaching (Wittrock, 1960; Armistead, 1960).

Wittrock (1960) was concerned with the problem of how teachers could facilitate a transition of specific background knowledge possessed by a pupil into the pupil's cognitive system of new, related information. Each of three groups (a total of 198 secondary-school pupils) was given one of three sets of directions: to look for similar, different, or neutral statements in two written passages. After analyzing data according to a factorial design which involved the three different sets of directions, grades, sex, and two intelligence levels, Wittrock concluded that subjects categorized and related materials in accordance with instructions. It appeared effective to direct pupils in the task of searching for similarities when they are present, or differences when differences are present, with an explicit statement that materials are basically similar or different. Such findings should be considered as teachers start new units of work.

Useful conclusions also were drawn from the study by Armistead (1960) dealing with the effect of stimulus change on exploratory drive. Sixty primary pupils, stratified on the basis of intelligence, were subjected to three experimental conditions involving repetitious materials. Armistead found that children of higher intelligence required more stimulus change to maintain high performance and that exploratory drive in children of lower intelligence could be sustained at a comparable level with less environmental change. It seems that overlap with previously learned material should be considered concurrently with the intelligence level of pupils, and provisions should be made accordingly for stimulus change.

A study by Webb and Schwartz (1959) seemed to indicate that length of material to be learned is, in itself, not as important as are other factors in the learning situation. They found that as the amount of information to be learned was increased, the variance in learning increased only to a point; error variance, however, continued to increase. They suggested that this latter increase might be attributed to such factors as fluctuation in attention, methods of learning, proactive and retroactive effects of inhibition, and guessing as a result of failure to recall.

In an applied study aimed at identifying specific kinds of difficulties affecting the learning of shorthand dictation materials, Hillestad (1960) found that error rate increased as words became longer. Gladis (1960) investigated transfer in grades 3, 5, and 7, varying the time interval between two verbal learning tasks. Results indicated that kind and amount of transfer may be functions of developmental factors.

Muehl (1959) reported a somewhat novel study dealing with recall, in which he used three tasks that involved meaningful material (recorded stories, paired adjectives, and paired picture names). He found no consistent differences in recall ability when differences in learning were held constant. This finding suggests that much of the variance in recall is attributable to variation in original learning.

Additional References: Al-Karbouli (1960); Haslerud (1959); Little (1960); Mills (1959).

Method Variables

Research dealing with method variables involved classroom organization, presentation procedures, and methods of evaluation and grading. Variations in classroom organization usually included such items as grouping, team teaching, and ungraded classes. Presentation procedures included independent study, project methods, lecture, discussion, recitation, and, usually, teaching style variables, i.e., how a teacher encourages a pupil to learn through discovery-directed, inductive-deductive, and laboratory-textbook approaches.

In a fair proportion of recently completed studies of method variables, results from experimental and control methods did not show statistically significant differences. Inferences should be drawn with caution, however. Lack of statistically significant differences does not imply that methods are equally good or indifferently appropriate. Demonstrating the effectiveness of any teaching method requires highly sensitive procedures in design and analysis. Bowers and Soar (1961) noted that before differences in method variables can be shown, concern must be manifested for the large number of measurable complex outcomes, for the numerous and elusive covariates that mask true differences between methods, and for the frequent inability of simple statistics to make possible adequate analysis of the data. Imaginative designs are needed.

Classroom Organization

The effects on learning of organizing a classroom into varying sizes and kinds of groups continued to receive considerable attention. Manning (1959) reported an evaluative study designed to develop a program of instruction "to serve individual learning needs." His data were analyzed in terms of the relative achievement of experimental and control groups of pupils in social studies, literature, and science. Findings suggested that the effects of individualization procedures vary both with pupils and with subject-matter area. For example, an experimental group of sixth-grade pupils in science and literature with IQ's of 120 and above made significant improvement; however, fifth-grade pupils in social studies, of the same ability level, made less progress than control pupils did. Although such results in classroom practices seem confusing, this type of experimental approach seems worth encouraging and repeating with necessary modifications until clarity is achieved. Only after more of this kind of research can we hope to determine which kinds of students can benefit in which subject areas from individualized programs in learning.

"Grouping: Promising Approaches" was the theme of an entire issue of *Educational Leadership* (1961). Although the four articles reported no research studies, their interpretation of research findings for curriculum practices and their suggestions about needed research should be helpful in planning attacks on the problem.

Three studies, all somewhat sophisticated in planning and analysis, reported no significant differences in learning outcomes between individual, small-group, and large-group methods. In studying a group of 128 fourth-grade pupils, half working in groups and half as individuals. Hudgins (1960) found no differences in individual problem solving. Siegel, Adams, and Macomber (1960) compared retention of information between two sample groups of college students matched on *ACE Psychological Examination* scores and found no significant differences in the effectiveness of large-group and small-group instruction. Wallen and Vowles (1960) compared a nongrouping procedure with a grouping procedure for four classes of sixth-grade pupils in arithmetic, equated on the basis of pretest achievement scores. Although no significant differences were found between these procedures, significant differences were reported between teachers and for teacher by method interaction. The latter suggested that some teachers were more successful in using a given method than were others.

On the other hand, Blue (1958) reported significant results in a study of college students in a sociology course. Students who studied in groups made higher achievement scores than students who studied independently. The data also indicated that all but the exceptional student improved when studying in an organized group. Beach (1960) used lecture, discussion, and small-group and independent study procedures in organizing an advanced course in educational psychology. He concluded that the less sociable students achieved more by lecture and that the more sociable students achieved more by the small-group procedure. McHugh (1960) worked with fourth-grade, fifth-grade, and sixth-grade pupils over a two-year period in an effort to initiate and evaluate team learning in such skill subjects as arithmetic, spelling, reading, and language. In general, the achievement gain apparently attributable to this procedure was significant for grades 5 and 6; no gain was reported for grade 4. Reading and language improved in grade 6, arithmetic in grades 5 and 6, and spelling in all grades.

That pupils' feelings are important in learning was indicated by Morgan and Stucker (1960), who found that an experimental method of teaching reading, the Joplin Plan, was superior to a traditional method. It was suggested that the new approach was better because it permitted teachers to offer more effective verbal and emotional rewards and allowed the slow student to function in a nonthreatening atmosphere which maximized positive feedback.

Additional research is suggested by these studies. Maturation factors and skill or previous experience in group procedures seem to be involved.

Pupils with certain characteristics seem to profit from experience when working with cognitive materials of a given kind, under the direction of certain teachers.

Additional References: Abramson (1959); Boesel (1960); McDougall (1958); McKeachie and others (1960); Schellenberg (1959); Smith (1960).

Presentation Procedures

A teacher's procedures for presenting material, obviously, must be related to his classroom-organization pattern. Using a variety of procedures and organizational plans, Nesbitt (1960) completed an extensive study involving pretest, post-test, and retention measures. Although each class achieved significant growth irrespective of the procedure (whether traditional or team teaching and whether or not teacher aides and modern educational media were used), no consistent differences in retention scores were found. It seems possible, however, that an over-all Hawthorne effect masked differences between methods.

In a study concerned with factual material, Robinson (1960) found that the addition of a lecture to an exhibit improved results, regardless of the arrangement of the exhibit. Some of the findings of Nachman and Opochinsky (1958) bear on circumstances in which lecture procedures appear to be effective. When quizzes were given without warning, material specifically covered in the lecture seemed to be recalled better by students in a small class setting than in a large one, although when students had studied for the final examination, scores for the classes did not differ.

Both of these latter studies question how much direction by the teacher is desirable and how different teaching really is from telling. Moss (1960) concluded that the direct-instruction and directed-discovery methods were equally effective with respect to initial learning, retention measured at one week and six weeks, and transfer of technical content after six weeks. The methods also did not seem to operate differentially for individuals of different intellectual ability. Similar results, in part, were obtained by Ray (1961), who found no differences between the direct-instruction and directed-discovery methods with regard to initial learning and retention at one week. The directed-discovery approach, however, was significantly better in terms of the pupils' retention at six weeks and their transfer at both one and six weeks. It is possible, of course, that task differences in these two studies might account for the differences in findings. Moss's (1960) study dealt with letterpress imposition, whereas Ray (1961) was concerned with micrometer principles and skills. Although a more abstract task (maze learning) was used in Aronov's (1958) exploration of the effects of consistent and inconsistent guidance on learning and transfer, his findings probably are related to those of Moss (1960) and Ray (1961). Aronov concluded that inconsistent guidance results in lasting damage to

learning if, for some reason, the recipient is unable to rebel or to ignore the guidance.

These studies were, in general, carefully done, but the use of small experimental populations is regrettable. Although classroom procedures run the risk of being overspecialized and lacking in generalizability, they are a promising area of research.

Additional References: Catterson (1959); Cummiskey (1960); Klugh, Deterline, and Henderson (1960); Marr and others (1960); Olson (1959); Popham (1961); Rivkind (1958); Swick (1960); Taylor (1959).

Evaluation Techniques

Duel (1958) found that when students were given periodic opportunities for self-evaluation, they made higher achievement scores than did students who were not given such opportunities. The results of a study by Bartlett, Ronning, and Hurst (1960) suggest that case studies are worthwhile and justifiable in evaluating ability to apply knowledge. Although evaluation procedures can be considered task variables, the emphasis in this study is on teachers' methods. For example, Page (1958) found that comments written on students' papers by secondary-school teachers had a measurable and significant effect on students' effort, attitude, and attention. There was no evidence that poorer students were less responsive than better students. Senior high-school students were more responsive to teacher comment than were junior high-school students.

Although the methods and techniques of test construction are well known to most teachers, there is opportunity for fruitful research in the improvement of learning and retention through evaluation. Little attention seems to have been directed to the comparison of evaluative techniques for this purpose; in fact, the organization of many schools seems to negate such efforts, and tests are too often seen only as evidence of having absorbed a given block of material.

Additional References: Eisner and Rohde (1959); Fattu (1957); French (1960); Kalish (1958); Standlee and Popham (1960).

Teacher Factors

The selection of both tasks and methods depends on factors inherent in the teacher. What the teacher knows and the effect of the teacher's knowledge on pupils' retention of learning are of concern in any consideration of task and method variables. The teacher's attitudes and behaviors also influence pupils' learning; this was shown, at least with regard to attitudes and behaviors having strong emotional tones, in a study reported by Torrance and Mason (1958). They studied the effects of various approaches by the instructor on a sample of Air Force personnel and

concluded that a direct "take-it-or-leave-it" approach was more effective than personal persuasiveness or setting an example. They also found that attempts to influence attitudes were more effective in the instructor's official role than in his personal role. Replication of this study using younger subjects would be desirable to test the generalizability of findings to include elementary-school and secondary-school situations. Other studies dealing with teacher influence are reviewed in Chapter VI.

Two studies seemed to indicate that relationship exists between teachers' knowledge and pupils' learning. Massey and Vineyard (1958) found significant correlations between students' college achievement records and global ratings of first-year teaching performance. Bassham (1960) found that teachers' understanding of mathematical concepts was significantly related to pupils' gain in arithmetic for students classified above the class mean, but not for those below. Inferences from these findings must be further qualified by the negligible correlations obtained by Heil, Powell, and Feifer (1960) between teachers' knowledge and pupils' achievement in the elementary grades.

Cohen's (1960) study showed that the procedures most teachers used for gathering information about students probably stimulated pupils' learning.

There is a continuing need for well-designed studies dealing with characteristics of teachers. Klausmeier (1961) aptly summarized the situation in a statement that needs specification and validation: "Cognitive and psychomotor abilities of teachers correlate lower with teacher success than do the same abilities of students correlate with . . . [the students'] success on school learning tasks. Efficiency of pupil learning, however, is enhanced when guided by a teacher who is intelligent, well prepared in the subject matter, a high achiever while in college, and generally well educated." It already has been demonstrated that teachers can learn different classroom approaches (Bowers and Soar, 1961), that valid assessment of teaching can take place (Hughes and others, 1959), and that individual differences in a variety of teacher traits exist (Turner and Fattu, 1960). The approach of Newell, Lewis, and Withall (1960) and the continuing research reviewed in Chapter VI promise to be of interest.

Task-Method Emphases

As indicated earlier in this chapter, task and method variables that affect learning and retention outcomes can seldom be dichotomized. Certain kinds of learnings reflect unique combinations of both task and method. What a teacher does (method) to promote pupil activity (task) that will result in learning and retention can be considered in terms of emphasis on such items as fundamental concepts, logical and critical thinking, and meaningful, positive learning sets. Ironside (1959) completed a study illustrative of task-method emphasis. He compared three related

teaching procedures for effectiveness in developing context clues for vocabulary development. Working with 211 pupils, with two equivalent tests of context-using ability, he found no differences in the results in classes taught deductively (in which the names and uses of five different clues were the subject of lectures), inductively, and by a combination procedure. The contrast in method may have been weakened by a Hawthorne effect.

In an effort to determine the relationship between kinds of memory and problem-solving ability, Hoffman (1960) administered a series of tests of various kinds of memory to 123 eighth-grade pupils. He identified the superior and poor problem solvers and compared their memory test scores. Although no relationships were found between problem solving and memory span, immediate recall, or delayed recall, significant relationships were found between problem-solving ability and incidental memory.

Educators need to be concerned not only with problem solving and memory but also with the development of such skills as critical thinking and listening. Representative studies in these areas were made by Herber (1959) and Trivette (1961). Herber found that ability to think critically could be improved by introducing specially prepared materials to pupils in grades 10, 11, and 12. Trivette concluded that training in specific listening skills could be accomplished by teachers, and that as listening skills improve, other comprehension skills also tend to improve.

In the area of concepts, there were three interesting studies which suggested additional needed research in the task-method area. Davis (1958) experimented with the development of certain time and space concepts by fourth-grade, fifth-grade, and sixth-grade pupils. Experimental classes were taught a unit specifically employing materials relating to the development of understandings about geographic time zones. Pretest, post-test, and retention-test scores served as the criteria, and intelligence was controlled through analysis-of-covariance procedures. By the end of one month, the experimental classes had gained significantly more in understanding than the control classes; no significant differences between grade levels were noted. Significant differences between grade levels and between the experimental and control groups were found at the end of the experiment. Thus, specific instruction in time and space concepts appeared valuable for pupil learning and retention.

Emphasizing specific instruction in chronology, Arnsdorf (1961) investigated a seven-week instructional program that fostered comprehension of definite and indefinite time terms, ability to recognize relative lengths of time between periods, skill in ordering events with dates, and competence in recognizing time absurdities. He concluded that through systematic instruction children can increase their understanding and their ability to use time relationships.

Using a design similar to that employed by Davis, Nelson (1958) in-

structed teachers in methods of teaching light and sound concepts. Pupils showed significant gain related to grade level.

These studies all seemed to indicate that when certain tasks are taught by appropriate methods, growth in concepts takes place. The occasional relationship of additional information gained and grade level suggests that research workers might concern themselves with the long-standing question of desirable scope and sequence in the school curriculum, and in particular, with the relation of sequence to the difficulty of tasks and the appropriateness of methods at different grade levels. As Davis (1958) suggested, the question is not, "What do children know?" but rather, "What can children learn?"

Additional References: Baldauf (1960); Cox (1960); Jacobs and Bollenbacher (1960); Parnes and Meadow (1959); Pimsleur (1960); Rothstein (1960).

Conclusion

Problems of research dealing with task and method variables will probably continue for some time. However, creative designs, well executed, and analyzed by sophisticated procedures, can help clarify them. Experimentation with tasks having plausible relationships to classroom behaviors of both pupils and teachers seems indicated. Needed also is research dealing with teachers' knowledge and its effect on pupils, on scope and sequence of specific subject materials, and on productive methods by which teachers may make evaluative procedures an integral part of the learning process. Research in these areas, however, must be anchored to a theoretical base if lasting value is to accrue.

Hullfish and Smith (1961) produced a provocative book on educational theory that may be helpful to research workers in formulating studies dealing with task and method variables. One of their points implies some rather specific advice, particularly when interpreted against the background of this chapter:

> The point of attack in bringing about a significant reconstruction of education—in the classroom where mind meets mind—is the reconstruction of the teacher. It is this organization that is essential for the creation of a reflective learning atmosphere. What finally counts in any reorganization of the curriculum, in short, is this reconstruction of the teacher.

A second work, in progress, also holds promise for directing the efforts of research workers. The current five-year study by Smith and others (1960) of the logic of teaching includes exploration of teaching as an independent phenomenon. If this study does indeed identify, classify, and analyze the operations of teaching as its researchers hope, research dealing with meaningful learning of pupils in the classroom will indeed be enhanced.

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CHAPTER VIII

Meaningful Learning and Retention: Practice and Reinforcement Variables

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INTEREST in the application of reinforcement psychology to meaningful school learning situations has developed rapidly in the last three years. Much of the interest was generated by the development of the teaching machine and programed learning approach, which provided a technique for investigating systematically some of the variables involved.

Noteworthy reviews of related literature were prepared by Krasner (1958), Salzinger (1959), Lewis (1960), Silverman (1960), Bandura (1961), and Stolurow (1961). Following Skinner's (1958) classic description of the principles and possibilities of teaching machines, there were two compilations of relevant articles, by Galanter (1959) and Lumsdaine and Glaser (1960).

This chapter categorizes selected research findings under four problems in learning: (a) evoking the desired response, (b) reinforcing the desired response, (c) maintaining and improving the desired response, and (d) eliminating the undesired response. Much of the literature under these headings reported experimentation with programed materials.

Evoking the Desired Response

Use of Prompts

An important problem, which received little attention, concerns the most efficient methods of cuing the learner. One issue is the relationship between prompting and confirmation. How many (if any) and what kinds of cues are most likely to be followed by the learner's correct response? What arrangement of confirmations after the response and cues before the response produces optimal learning? On these questions no experimentation with meaningful learning was located, but Angell and Lumsdaine (1960) found that a sequence of three prompting trials followed by a confirmation trial produced better learning of paired associates than prompting trials alone. They hypothesized as follows: "Have the learner respond to the minimum value of cue strength which is sufficient to insure a correct response." Research with more meaningful learning tasks

* This chapter was written while the author was at Michigan State University. He wishes to express appreciation to the College of Education at Michigan State University for support in preparing the chapter and to Richard Bland Smith for bibliographical assistance.

is needed to validate this principle; if future research should support it, teaching machine programs with overdetermined responses could be improved. The emphasis on errorless learning resulted in some programs in which more cues were provided than were necessary to insure the correct response. Consequently, the learner might make the right response by attending to an irrelevant cue.

S. R. Meyer (1960a) reported a study of the error rates associated with different kinds of prompts in teaching eighth-grade students English roots and prefixes with a programed textbook. She found, for example, that relatively few errors (3 percent) were made when the correct response was the same as an emphasized word in the frame. Most of the errors (59 percent) were made when the prompt called for the student to perceive an analogy between two examples. No generalizations about the relative difficulty of prompts should be formed from these data, however, because of the few frames of each type involved, the uncontrolled difficulty level of the words in each frame, and the fact that some categories of prompts were specific to her particular program. One of the pressing needs was for a generally applicable and theoretically based taxonomy for prompts. Useful approaches were developed by Skinner (1958), Gilbert (1960), and Homme and Glaser (1960).

Construction Versus Selection of Responses

With a few modifications, the old battle of the essay test *versus* the objective test can be refought on the question of whether the learner should be asked to compose his own response or select it from a list of alternatives. A resolution may be just as difficult to achieve, since the choice of a criterion appears crucial.

Of the four research studies on this question, two concluded that constructed-response (fill-in) programs produced more learning than multiple-choice programs when the criterion test was also of the constructed-response variety, but not when it was an objective test. In the other two studies no significant differences were noted.

Coulson and Silberman (1960) used part of the Harvard program in elementary psychology, which was later published (Holland and Skinner, 1961). They found that on a 19-item constructed-response criterion test the constructed-response format was superior to the multiple-choice format only when a nonbranching (all students take all steps) program was used. However, the constructed-response format required an average of 54 minutes in comparison to 44 minutes for the multiple-choice type program.

Similar results were obtained by Fry (1960) with his Spanish-English vocabulary program, which, however, was not a continuous-discourse program. It consisted of 16 English words; the student first supplied the Spanish translation and then checked the correctness of his response.

On an eight-item constructed-response test, the constructed-response format produced superior learning over a multiple-choice format, as measured by both immediate and delayed tests, even when learning time was held constant for both groups.

No such differences were obtained by Roe and others (1960) when freshman engineering students studied elementary probability by different methods, including both multiple-choice and constructed-response teaching machine programs. A similar failure to find significant differences was reported by Evans, Glaser, and Homme (1960b) with a symbolic logic program. They explained the absence of significant differences in studies of this kind with the following hypothesis: "The relevance of variables such as response mode and immediacy of confirmation is inversely related to the probability of correct responding." This hypothesis is consistent with the results reviewed here. Thus, in a program in which there is a high probability of a student's answering each element correctly, as in the studies by Roe and others (1960) and by Evans, Glaser, and Homme (1960b), the form of his response is unimportant. But when the initial probability of a correct response is low, as in the Fry Spanish-English program, the form of response becomes more critical. Since the difficulty level of Coulson and Silberman's (1960) program was not reported, interpretation of their results in light of the above hypothesis is not possible.

Overtness of Response

How important is it for the learner to make overt response during the learning process? Although some response appears theoretically desirable, the seven studies on this topic failed to show any advantage for learners instructed to make overt instead of covert responses. Indeed, some studies showed that the instructions consisting of simple direction to read programed material that had the answers already written in the blanks appeared to be at least as effective as, and far more efficient than, any other procedure. This conclusion must, of course, be tempered by the limitations of the studies themselves.

Silverman and Alter (1960) reported that the 30 undergraduates who read the programed items on basic electricity without overtly responding scored significantly higher on an eight-item fill-in test than the 30 students who filled in the blanks on the program. No information was given in the one-page article on such factors as the difficulty or length of the program, the time allowed each group, or the method of assignment of subjects to treatment.

An experiment by Goldbeck, Campbell, and Llewellyn (1960) compared the relative effectiveness of four modes of response: overt, covert, optional overt or covert, and reading. The 32 frames of the program on

light had an average difficulty level of 84 percent for the 62 eighth-grade pupils. A quiz administered immediately after the program revealed no significant differences among the means of the four response modes, although the mean obtained for the reading mode was slightly higher. Since the reading mode was accomplished most quickly by the students and the written overt mode required the longest time, an index of learning efficiency greatly favored the reading method of presentation. The use of efficiency indexes such as this may be dangerous because of the nature of the scales involved.

An interesting side light on this experiment concerns the amount of time required for students to complete the criterion quiz under each condition. The students in the reading mode required the longest time, whereas students in the overt response mode required the shortest time —directly the reverse of the amount of time taken to complete the program. A possible interpretation is that the reading group was not as certain of its responses and thus might not have been able to retain the material as long as students under the overt response condition.

Evans, Glaser, and Homme (1960a, b) reported two studies in which overtness of response was investigated. In neither case could significant differences be found, although the small number of students in each treatment group did not allow for a very powerful test of significance.

Kaess and Zeaman (1960) investigated the overtness of response variable with multiple-choice type questions. The learning material consisted of 30 multiple-choice test items on psychological terminology, arranged in no logical sequence. Students who merely observed the correct underlined answer did as well as students who observed the correct answer and also punched that answer on the punchboard.

Roe and others (1960) found that the programed textbook which required no overt responses took significantly less time to complete and resulted in a slightly, though not significantly, higher score on the criterion test than did the programed textbook which required written responses.

In a task involving the learning of light circuits, Hillix and Marx (1960) found that students who learned by their own trial and error had more difficulty than those who watched someone else make the same trials and errors. However, on trials with material to which the learning should transfer, the overtly responding group showed a slight superiority.

Although all the evidence so far reported fails to support a presumption of the importance of overt response, the question should not be considered settled. The studies reported here were based on very short programs or learning tasks. The criterion tests were always administered immediately after the completion of the program, and no delayed measures of retention were obtained. Goldbeck, Campbell, and Llewellyn (1960) mentioned a previously conducted study (currently unavailable) in which the difficulty level of the individual frames in the program was related to the importance of overt response. Overt written responses were more effective with difficult material, but covert responses proved more efficient with easy material.

Such a finding is consistent with the hypothesis of Evans, Glaser, and Homme (1960b) mentioned previously.

Reinforcing the Desired Response

Effectiveness of Reinforcers

The well-documented principle that the learner performs best when given knowledge of results received additional support in a variety of contexts. Oakes, Droge, and August (1960) demonstrated the reinforcing effects of a signal light which informed group discussion participants of the presence or absence of psychological insight in their comments. Those receiving positive reinforcement emitted progressively more words toward the end of the discussion than those who had been signaled that their comments indicated a lack of psychological insight. In a similar follow-up study the same authors (1961) discovered that the content and conclusions of a group discussion can also be influenced by reinforcement supplied to the participants. Since the subjects were psychology students, discussing psychological problems and being reinforced by a professional psychologist in their display of psychological insight, it is not surprising to find that their conclusions were influenced by the reinforcement. There is need for further experimentation designed to isolate each of these influences: type of learner, nature of subject matter, response category to be reinforced, prestige of the reinforcement administrator, and nature of the reinforcer.

If knowledge of results is to be used as a reinforcer, how should the learner be given the results? Should each response be followed by *right* or *wrong*, or by *right* or nothing, or by nothing or *wrong?* Curry (1960) and Meyer and Seidman (1960, 1961), in several studies on concept formation, investigated this problem with fairly uniform results. In general, when children were told that their incorrect responses were *wrong* and when their correct responses were either ignored or called *right*, they developed the correct concept more quickly than when correct responses were called *right* and wrong responses ignored. The reason for this result probably is related to the nature of the learning task involved. As Meyer and Offenbach (1961) pointed out, the word *wrong* is probably more effective because it conveys more information than *right* when many irrelevant cues are present in the two-choice problems. The word *right* positively reinforced responses to such irrelevant cues as the color, height, or shape of blocks when the relevant cue was, for example, area of the base. Their experiment confirmed a significant interaction between task difficulty (number of irrelevant cues) and reinforcer combinations. Only when two or three irrelevant cues were present did the *right*-nothing combination prove inferior. With only one irrelevant cue, *right* became just as informative as *wrong*, and no significant difference in rate of learning was observed.

The implications of this finding are consistent with the previously quoted hypothesis of Angell and Lumsdaine (1960) that the learner

should be provided only the minimum number of cues necessary to produce the correct response. Too many hints may enable him to give the right answer in response to irrelevant cues.

Does providing the correct answer after a response produce better learning than mere knowledge that the response was right or wrong? It does, according to Bourne and Pendleton (1958), in a geometrical concept formation task, and according to Chansky (1960), who asked students to learn age expectancies of items in the *Vineland Social Maturity Scale.* Complete information was more useful than an evaluative reinforcer. However, Donahoe's (1960) study suggested the possibility that too much unassimilated information feedback can impede the solution of a two-dimensional geometric game.

Kaess and Zeaman (1960) reported a study in which they compared the effects of the number of distracters in multiple-choice items on student learning of 30 psychological definitions. The fewer the number of distracters presented initially, the more quickly the students mastered the definitions in subsequent trials. An analysis of errors showed that students made the same errors repeatedly, although they were consistently provided with information that they were wrong. Students who were initially provided with only the correct answers made the fewest errors on all subsequent trials. Such a finding strengthens the prompting argument in the prompting-*versus*-confirmation issue. It points up the importance of insuring that a student's first response is correct. To summarize the findings so far, then, the ideal teacher is one who can provide no more than the minimum number of relevant cues to guarantee a student's success on the *first* trial.

Immediate Versus Delayed Reinforcement

The following three studies all tended to confirm the desirability of immediate reinforcement, although their operational definitions of this term are sufficiently different to require separate comment. S. R. Meyer (1960b) compared the effectiveness of programed textbooks when the correct responses were given to the pupils 24 hours after the initial response to the conventional programed textbook, in which students could obtain immediate confirmation. The delayed-reinforcement group made almost twice as many errors on the program and scored lower on the criterion test than the immediately reinforced group.

Group-discussion skills were found by Loree and Koch (1960) to be significantly improved through the use of positive reinforcement presented by the experimenter immediately following a reproduction of the response rather than by the subjects' listening to the response itself.

A study by Sax (1960) showed that a delay in providing knowledge of results ranging from 0 to 40 seconds had a significant influence on

the number of trials necessary to associate characteristics of Chinese symbols with nonsense syllables. The longer the delay, the more trials were necessary to obtain the criterion. A check on retention two weeks later, however, revealed that whatever differences initially existed had disappeared.

Schedules of Reinforcement

How often should the learner be reinforced for correct responses? The schedules investigated included the following: (a) continuous, where every response is reinforced; (b) fixed ratio, where every *n*th response is reinforced; (c) variable ratio, where an average of one in *n* responses is reinforced irregularly; (d) fixed interval, where the first response after a constant interval since the last response is reinforced; and (e) variable interval, where the first response after some variable (within a specified average) interval since the last response is reinforced.

Consistent rates of responding under each schedule of reinforcement have been noted for some infrahuman species, but experimental tests of various schedules with meaningful human learning have been difficult to devise. In one attempt by Green, Sanders, and Squier (1959), subjects were asked to pull a lever as soon as they could whenever a "correct" pattern of lights appeared. They found that subjects learned to respond to the correct pattern more often under ratios involving more reinforced than unreinforced trials and under schedules with short time intervals.

Generally, continuous reinforcement appears to be superior to various schedules of intermittent reinforcement in acquiring concepts, according to Chansky (1960), Bourne and Pendleton (1958), and Bourne and Haygood (1960). Sax (1960), however, was unable to find a significant difference between a 50 percent variable ratio schedule and a continuous schedule of reinforcement, either on number of trials for acquisition or on retention.

Difficult research problems in scheduling reinforcement are numerous and could have important implications for teachers. Most teachers reveal an implicit awareness of the problem when they often ignore Johnny's continually raised hand, and yet call on shy Susan every time she volunteers. What schedules of reinforcement are most effective with what kinds of pupils? Is continuous reinforcement best for acquiring concepts and skills but some other schedule best for maintaining the response in strength? What schedule of reinforcement will best guarantee that the learner will continue to emit polite phrases, for example, in the absence of the person originally administering the reinforcers? A convenient summary of certain animal research on schedules of reinforcement with suggestive analogies for human behavior appeared in a programed textbook by Holland and Skinner (1961).

Maintaining and Improving the Desired Response

The nature, conditions, amount, and distribution of practice with meaningful material have received little attention during the past three years.

Maier and Hoffman (1960) asked whether a group's second solution to an industrial human relations problem would be superior to its first solution. They found on the average that the second solution was not only more "integrative" but also more acceptable to the group producing it and was completed in two-thirds the time of the first solution.

Practice under variations of whole and part methods was investigated by McGuigan (1960), using one card in the *Kohs Block Design Test.* In general, he found that practicing the task as a whole resulted in significantly faster criterion performance than did various combinations of learning the parts. He interpreted his results under the hypothesis that whole learning is superior largely because it entails distributed practice. A test of this hypothesis could be made by revising his procedure slightly. Instead of asking the subjects to reproduce each quadrant of the card twelve consecutive times as McGuigan did under the part method, subjects could be asked to reproduce separately, but in turn, each of the four quadrants. Subjects would still be learning parts, but would be distributing their practice rather than massing it on any one quadrant. Another procedure for testing the hypothesis would be to allow longer time intervals between trials of the part method to allow reactive inhibition to dissipate.

The problem of distribution of practice has not yet begun to be investigated in programed learning, although the method is ideally suited to the problem. The spacing of review frames in a programed learning sequence could easily be manipulated and effects on long-term retention measured. Hypotheses derived from rat studies and nonsense syllable studies could readily be tested with meaningful learning material on human subjects.

Eliminating the Undesired Response

Optimal Error Rate

The controversy about the value of students' errors is far from resolved. Skinner (1958) built a strong case for errorless learning, and Pressey (1960) raised sharp questions about ways students may learn from mistakes. Fruitful research on this important problem can probably resolve the issue as soon as consensus is reached on the criterion behavior desired.

Melaragno (1960) inserted five deliberately ambiguous frames in a 50-frame teaching program and called all responses to these five frames

wrong. Arranging the five frames consecutively in the middle of the program caused significantly lower criterion test performance, particularly on the information taught by the frames immediately preceding and succeeding these frames. When these difficult frames were evenly distributed throughout the program, Melaragno concluded that learning was not disrupted. Acceptance of this conclusion should be tempered by the fact that 9 persons receiving only positive reinforcement scored higher on the criterion test than the 10 persons receiving spaced negative reinforcers, i.e., the difficult frames. The difference was computed to be significant at the 20 percent level by a nonparametric test. Although the author chose to call this difference nonsignificant, a more powerful statistical test or a slightly larger sample size might have led to rejection of the null hypothesis at conventional levels.

Holland and Porter (1960) readministered a criterion test six months after the first administration to 14 students who had completed the Harvard psychology program. The answers that had proved easiest on the first test were not forgotten as often as were the answers to initially more difficult test items. Such results may be interpreted as consistent with the principle that overlearned material is retained better than partially learned material, but they do not necessarily support the authors' claim that a program providing for low error rate leads to greater retention.

Shay (1961) was unable to find any consistent relationship between the difficulty of a program and the score on a criterion test in a study of fourth-grade children learning Roman numerals. This may have been because the actual difficulty levels of the frames in the three programs were not sufficiently different to provide a powerful test of the hypothesis, although the three alternative programs varied greatly in number of steps. One of the major methodological problems in investigating optimal difficulty levels consists of finding a way to produce programs of varying difficulty levels without confounding other variables, such as number of steps or time required. Melaragno's (1960) method of inserting deliberately ambiguous frames provided one promising approach.

Procedures for Dealing with Errors

Student's errors always have been a problem, and the question of what to do with them is particularly vexing with constructed-response programed material. Although many suggestions have been made, the only experimentally tested method in constructed-response programs has been to repeat incorrectly answered frames. S. R. Meyer (1960b) reported no significant difference on a criterion test between pupils who repeated missed items and those who simply ignored their errors. However, the subjects who were given instructions to repeat any incorrectly answered frames scored 21.0 percent of their errors as correct, in contrast with the nonrepetition group who inaccurately scored only 8.8 percent of their

errors. This significant difference means that the repetition group actually evaded the requirement to correct their errors, probably perceiving it as a punishing consequence.

A similar study by Holland and Porter (1960) compared seven college students who repeated incorrectly answered frames with seven who did not repeat frames. They found consistent and significant superiority for the repetition group at all levels of criterion difficulty, although about 10 percent more time was required for the repetition group.

Coulson and Silberman (1960) reported a study by an active group at System Development Corporation, who experimented with multiple-choice programs in which students were routed through the program by a process which depended on the nature of their responses. This process, termed branching, permits appropriate variation of the program to remedy errors, repeat sections, or drop out easy parts, depending on the learner's needs. No significant differences were found at first between branching and nonbranching conditions. A later report of two experiments stated that a program in logic rewritten in paragraph form produced significantly superior criterion performance in comparison with a fixed-sequence program. A simple back-branching method was of intermediate value, according to Silberman and others (1961). The second experiment in this report made use of a more elaborate computer-controlled teaching machine. One group was allowed to branch to remedial items on the basis of its errors, while members of the fixed-sequence group took the same sequence of frames followed by their paired mates in the branching group. No significant difference resulted.

A most recent attempt by Coulson and others (1961) to demonstrate the superiority of a branching procedure over a fixed-sequence procedure was successful, but the special conditions of the experiment favored the branching group. Of some importance is the fact that the sequence of items for the fixed-sequence group was prepared by one independent consultant who made the sole judgment of what constituted an effective instructional sequence. The presumed advantages of branching may exist, but further experimentation will be necessary to specify the exact conditions and techniques most favorable to the branching method.

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